

A high-contrast, black and white line drawing illustration. Two men are shown in profile, looking down at a large, complex electronic device. The man on the left wears glasses and a suit. The man on the right has a mustache and is also in a suit. They are both holding pens, appearing to be working on or inspecting the device. The device has various components, including a large panel with a grid of lines and a small rectangular component labeled 'RACAL'. The background shows a window with a grid pattern.

**OPERATING & MAINTENANCE**

PANORAMIC ADAPTOR

TYPE RA.66

**RACAL**

PANORAMIC ADAPTOR

TYPE RA.66

Operating Manual

Technical Handbooks Department

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## CORRIGENDA

The following corrections should be made to this handbook.

### Parts List

Capacitor C33 changed from Type LEM 1106R to LEM 1510E.

Capacitors C40 and C70 changed from Type Hunt L28/1, JD26T to L28/1 MEW17T.

### Part 2, Section 1, Test Equipment

- (1) Valve millivolt meter reading up to 10 volts at frequencies up to 5 Mc/s and with a probe capacity of not greater than 7pF.

Note... Generally, a valve voltmeter with approximately 7pF or less probe capacity should be used during all tests, and this capacity should be padded where necessary to the precise value required.

### Part 2, Section 2, para. 2.2

This should read:- Heterodyne injection levels are measured as follows and with the valve removed:-

- (2) Pin 7 of V3: 5 volts r.m.s. approx.  
(4) Pin 7 of V13: 8 volts r.m.s. approx.

### Part 2, Section 3, para. 3.2.3

Delete reference to Sect. 4.

### Part 2, Section 3, para. 3.2.7

This should read:- The response is within 3dB throughout the passband.

### Part 2, Section 4, para. 4.7

This should read:- Remove V3 and V13. Peak the response of L4 and L10 with the valve millivolt meter connected, in turn, to pin 7 of the valve holders of V3 and V13. Replace V13.

## SECTION 1

### GENERAL DESCRIPTION

#### 1.1 Technical details

The Panoramic Adaptor Type RA.66 used with the Communications Receiver Type RA.17 provides a visual display of signals in any selected frequency band lying between 1 and 30 Mc/s. The maximum spectrum width that can be viewed is 1 Mc/s and this is selected by the MEGACYCLES dial on the RA.17 Receiver: the spectrum on the cathode-ray-tube of the RA.66 can also be expanded to show wider spacing of viewed signals.

The exact position of the KILOCYCLES tuning control on the RA.17 Receiver can be seen on the display and an internal 100 kc/s oscillator also provides visual marker points.

The RA.17 undergoes a slight modification by the addition of a buffer amplifier between the second and third mixer stages. The sub-assembly for this modification together with a coaxial socket for leading out of the second v.f.o. frequency are provided with the RA.66 Adaptor as a modification kit.

The complete Panoramic Receiver Type RA.81 comprises a modified RA.17 and the RA.66 Adaptor.

#### 1.2 Mechanical details

The unit is constructed on a heavy gauge sheet steel chassis which carries signals circuits, sweep and calibration generators together with all power supplies including those for the cathode-ray-tube. Controls for the Adaptor are mounted on an  $8\frac{1}{4}$  in. sheet steel panel which conforms with the standards required for mounting in a 19 in. rack. The tube is viewed through a specially shaped escutcheon which carries a removable deep yellow filter.

When mounted with the RA.17 Receiver in a cabinet to form the RA.81 Panoramic Receiver, the RA.66 is separated from the RA.17 by a  $1\frac{3}{4}$  in. ventilating panel.

#### 1.3 Technical Specification

##### Frequency Sweep

Continuously variable spectrum width from 100 kc/s to 1.0 Mc/s (max) between discrete Mc/s tuning points.

	Spectrum centre control permits selected sweep to be centred anywhere in the explored band.	
Sweep times	2 sec. and 2/10 sec.	
Resolution	Signal channel bandwidths 1.2, 3 and 8 kc/s.	
Display	<p>Rectangular cathode-ray-tube with 5ins.x 1 in. screen (Mullard Type DP. 16-22). Blue fluorescence with long green afterglow.</p> <p>Vary deep yellow filter (minus blue).</p>	
Sensitivity	With R. F. GAIN control set to maximum and with linear signal-channel amplification, 1 in. Y deflection is provided with 4 $\mu$ V at the aerial of the RA.17 Receiver.	
Dynamic range	Using logarithmic signal channel amplification, the range is 60 to 70 dB.	
Frequency markers	<p>(a) Movable marker indicates the frequency to which the RA.17 Receiver is tuned.</p> <p>(b) Fixed markers at 100 kc/s intervals are derived from an internal crystal oscillator.</p>	
Valves	Type	Quantity
	6AU6	10
	12AT7	4
	6BA6	2
	1X2B	2
	6X4	1
	6AS6	6
	6AL5	2
	VR150/30	3
	5V4	1

**Power Supply**

Voltage 100-125V and 200-250V.  
Frequency 45-65 c/s  
Consumption 180VA approximately.

**Finish**

Panel - light admiralty grey.  
Chassis - cadmium plated.

**Dimensions**

RA.66 Adaptor (chassis and front panel).

Height	Width	Depth
8.75	19	19 in
22	48	48 cm.

RA.81 Receiver (cabinet mounted  
RA.66 and modified RA.17)

Height	Width	Depth
24	20.5	22.5 in.
61	52	57 cm.



## SECTION 2

### INSTALLATION

After carefully unpacking the equipment, check that all valves and screening cans are firmly in place. Ensure that the chassis and power supplies are completely clear of fluff and shavings.

#### 2.1 Supply

Ascertain that the transformer tapings have been set to the appropriate voltage. Connections should be made to the primary transformer terminals shown in figure 1 and in accordance with Table 1.

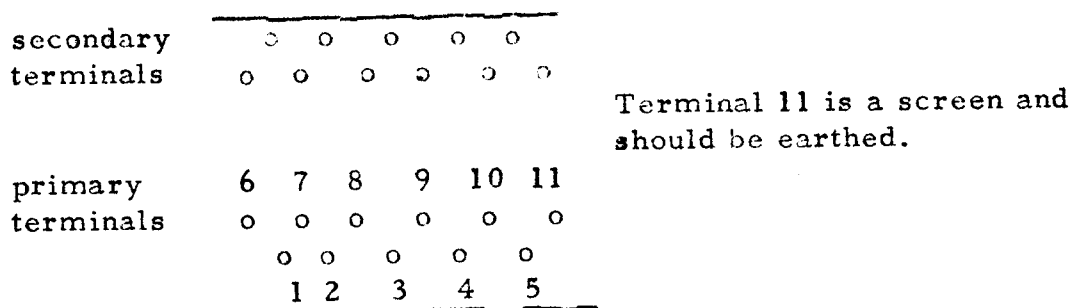


Fig. 1 - Main transformer connections

TABLE 1

Mains Voltage	Join:-	Join:-	Connect Mains (POWER) to
			(Pink wires)
100	3 and 8	4 and 9	8 and 9
105	2 and 7	4 and 9	7 and 9
110	1 and 6	4 and 9	6 and 9
115	3 and 8	5 and 10	8 and 10
120	2 and 7	5 and 10	7 and 10
125	1 and 6	5 and 10	6 and 10
200	3 and 9		4 and 8
210	2 and 9		4 and 7
220	1 and 9		4 and 6
230	3 and 10		5 and 8
240	2 and 10		5 and 7
250	1 and 10		5 and 6

The primary winding of the e.h.t. transformer and the cooling fan should always be connected to terminals 6 and 9.

## 2.2 Fuses

Ensure that the fuse ratings are correct:

POWER FUSE 3A  
B+ FUSE 250mA

## 2.3 Installation of RA.17

The RA.17 Receiver should be installed in accordance with Part 1. Section 2 of the relevant handbook.

## 2.4 Connection to RA.17

The following connections should be made between the RA.66 Adaptor and the RA.17 Receiver.

<u>RA.66</u>	<u>RA.17</u>	<u>Connector</u>
SIGNAL SPECTRUM INPUT	2nd-3rd mixer buffer amplifier	Coaxial
2ND V.F.O. INPUT	2ND V.F.O. OUTPUT	Coaxial
Ground	Earth (ground)	Single core or braid

## 2.5 RA.17 Modification unit

This unit consists of a single stage buffer amplifier for insertion between the second and third mixer to be fed to the RA.66 via a coaxial interconnecting cable, it protects the coupling circuit L59, C127 C128 and C129 from the consequent detuning effects, and maintains the gain and level frequency response of the second and third mixers over the 2-3 Mc/s spectrum. Thus the performance of the RA17 is in no way impaired by connection of the RA.66.

### 2.5.1. Modification Instructions

Note: These are complete modification instructions which cover all models of the RA.17. It may be found that the modification has been partly catered for in as much that all drilling has been done and the r.f. plug fitted to the second v.f.o. (on recent models only).

1. Remove the second v.f.o. as detailed in Section 7.2 (b) of the RA.17 handbook.
2. Remove the bottom cover from the second mixer compartment, unsolder the connection to R61 and remove the sub-chassis carrying L51 and L52. (see illustrations 1 and 2 in RA.17 handbook.)
3. Place the modification unit on the RA.17 chassis so that its two coil cans are in the same relative positions as the original L51 and L52. Partly secure the modification unit to the RA.17 chassis by means of two 6BA screws and their corresponding tapped holes. Spot through the remaining 3 fixing holes, drill .086 in. diameter x 3/8 in. deep, and tap 6BA.
4. Remove the modification unit, turn the RA.17 base upwards and drill 1 hole .281 in. diameter through the main chassis in the position (approximately) shown in the sketch (fig.2). Clear away all burrs and swarf, and insert the grommet supplied in the .281 in. diameter hole.
5. Pass the flying leads on the modification unit through their unit by 5 off 6BA x  $\frac{1}{4}$  in. cheese-head screws and washers supplied.
6. Make the following connections:-

<u>Lead from mod. unit</u>	<u>Connection point in RA.17</u>
Red. (h.t.)	Junction L53 R66
Brown (heaters)	Junction L54 C132
Yellow (input)	R61

7. Replace the cover on the second mixer compartment. Remove the bottom cover from the second v.f.o. Unit. Remove the screw which secures the twin cable clip to the second v.f.o. chassis.
8. Using a stop in order to limit the depth to  $\frac{1}{4}$  in., drill the holes indicated in fig.3. A length of tube slipped over the twist drill is suggested as an effective drill stop.

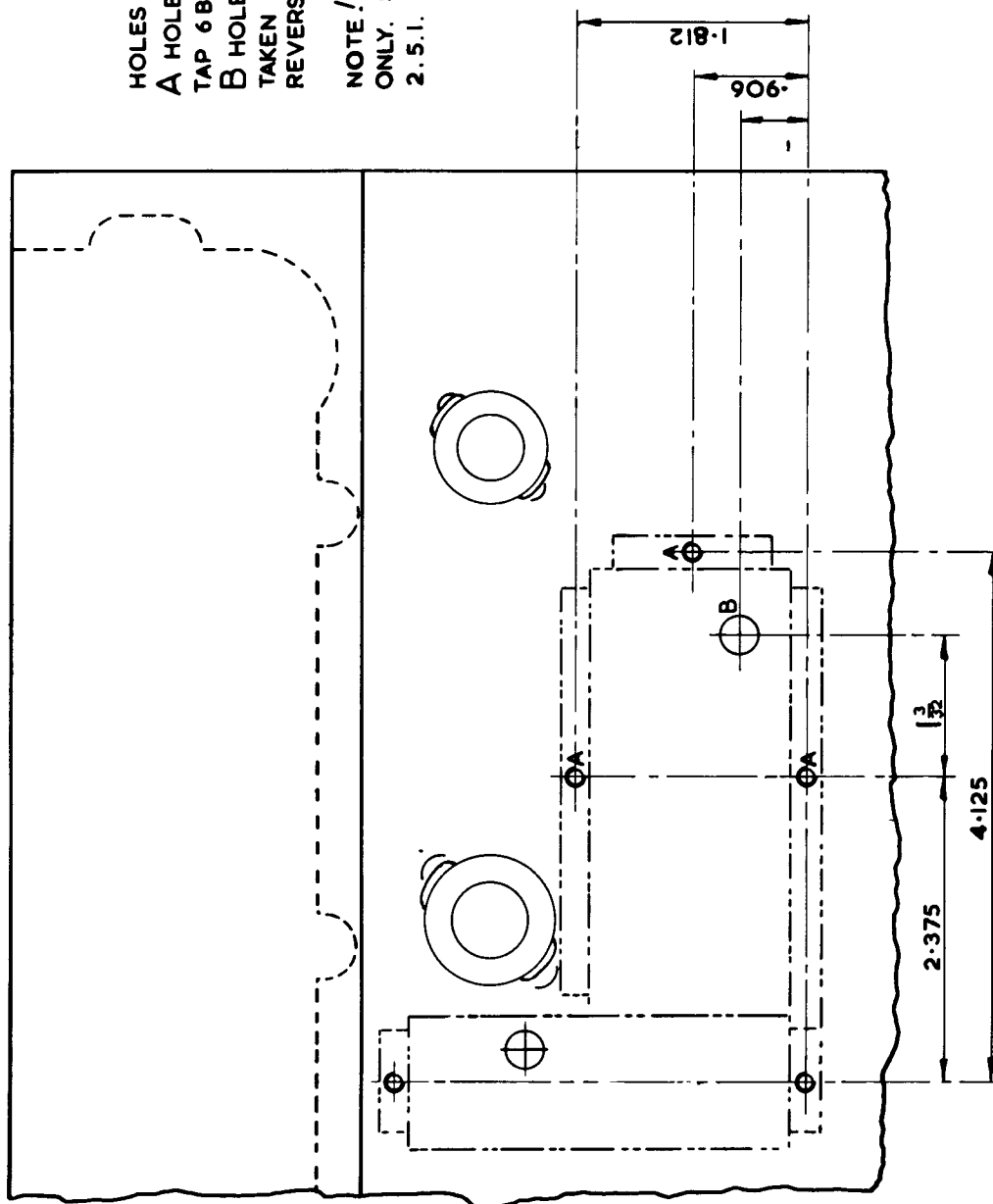
Note: Do not remove L55 or disturb the associated wiring.

9. Fit the r.f. plug in the .437 in. diameter hole, and connect the 2.2pF capacitor between the plug and pin 5 on V12.

10. Ensure no swarf remains in the second v.f.o. unit, and replace the bottom cover.
11. Secure the twin cable clip in position, using a 6BA x 3/8 in. screw in the new tapped hole.
12. Reassemble the second v.f.o. unit main chassis and front panel.

The newly fitted plug provides the 2.1-3.1 Mc/s tuning marker output to V12 of the RA.66.SKT4 from the second v.f.o. chassis is now connected to PL7 on the modification unit; P14 on the modification unit provides the 2-3 Mc/s signal spectrum output to V1 of the RA.66.

- 5.5 13. Check the setting of C128 (see illustration 6) as detailed in Section 6.5 of the RA.17 handbook. Tune the RA.17 to 3.75 Mc/s; a spurious response may be heard in the loudspeaker and, if this occurs, it can be eliminated by adjustment of the tuning slug in L52 (fig. 5.). Now connect the RA.66 to the RA.17 as indicated in para.2.4. Ensure that the RA66 is displaying a complete one-megacycle spectrum: this can be checked with the eleven tuning markers (section 3.6.4). Set the MEGACYCLES dial (RA.17) to the 3Mc/s position when a spurious signal will be seen against the first (extreme left-hand) marker; remove the tuning slug from L51B in order to adjust the slug of L51A until the spurious signal disappears. Replace the slug in L51B and set the MEGACYCLES dial to the 2Mc/s position when a second spurious signal will be seen against the eleventh (extreme right-hand) marker; adjust the slug in L51B until the spurious signal disappears.

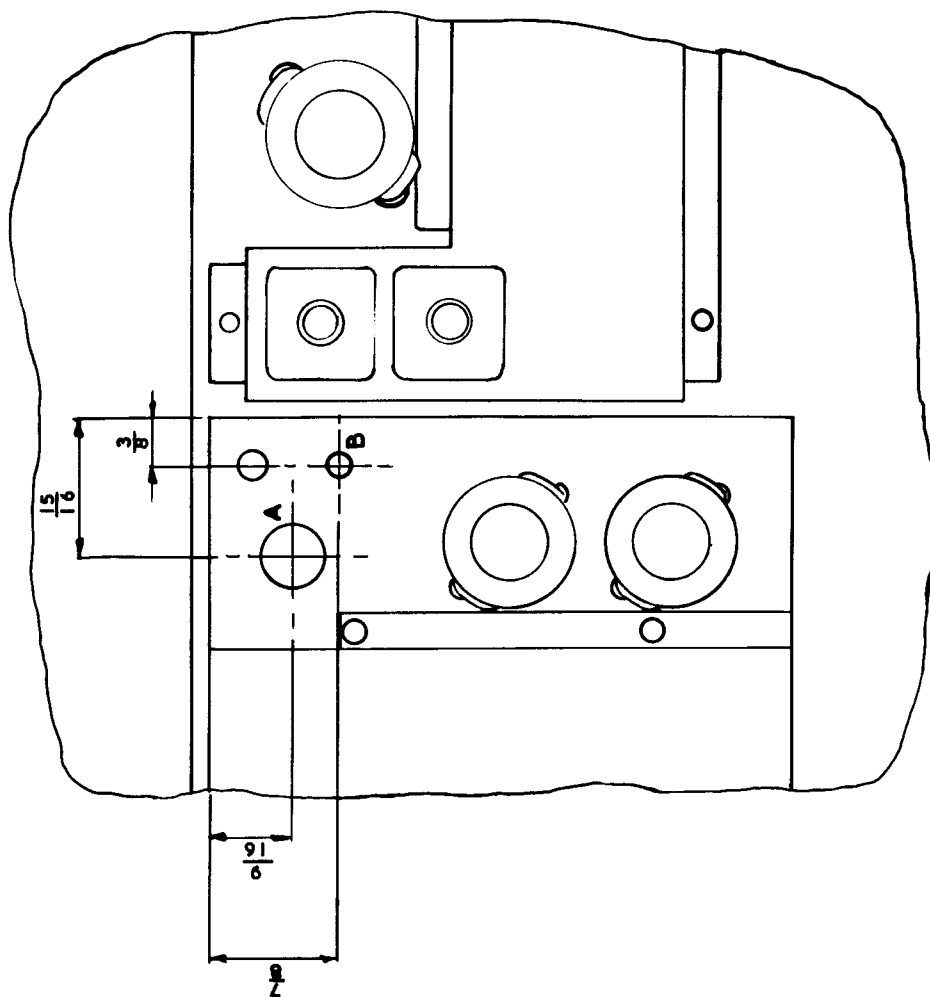


HOLES MARKED A & B ARE ADDITIONAL  
A HOLES .086 DIA. X 3/8 DEEP MAX. &  
TAP 6 B.A.

B HOLE .281 DIA. CARE SHOULD BE  
TAKEN TO AVOID COMPONENTS ETC., ON  
REVERSE SIDE OF CHASSIS

NOTE! DIMENSIONS ARE FOR REFERENCE  
ONLY. SEE TEXT IN HANDBOOK, SECTION  
2.5.1.

DRILLING INSTRUCTIONS FIG.2

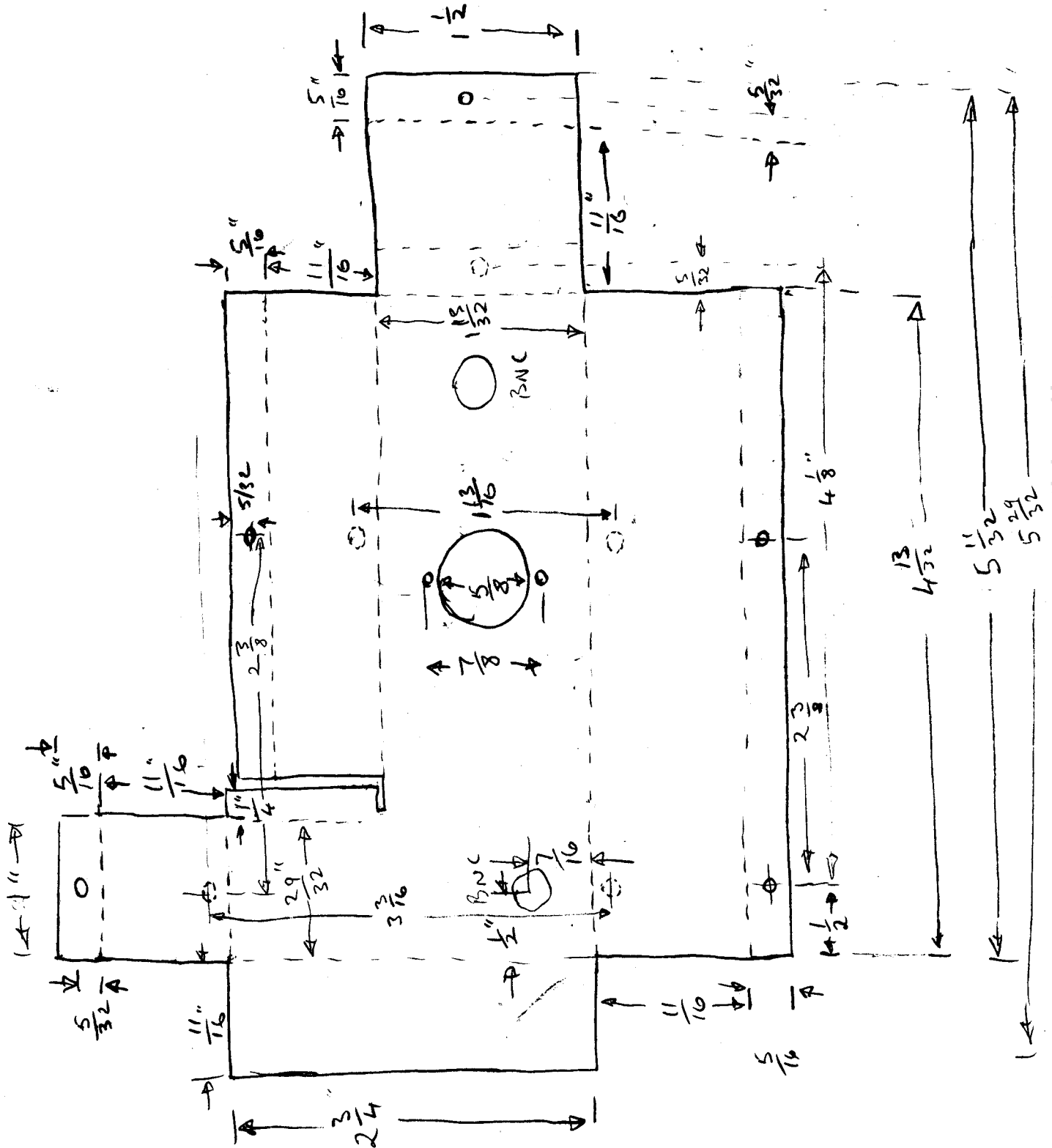


HOLES MARKED A & B ARE ADDITIONAL  
 A HOLE .437 DIA  
 B HOLE .086 DIA & TAP 6 B.A.  
 CARE SHOULD BE TAKEN TO AVOID  
 COMPONENTS ON REVERSE SIDE OF  
 CHASSIS. SEE TEXT IN HANDBOOK  
 SECTION 2.5.1.

DRILLING INSTRUCTIONS FIG 3

MA25( CHASSIS DETAIL

MAT: .8MM AL



## SECTION 3

### OPERATION

#### 3.1 General operation conditions

When the RA.17 is employed in conjunction with the RA.66., the operation and performance of the RA.17 are in no way altered or impaired. Controls on the RA.17, other than those mentioned in the instructions in this section, have no effect on the RA.66 display.

These instructions should be used in conjunction with those for the RA.17 Receiver. Designations of the RA.17 controls, shown in brackets in these instructions, refer to N.American versions of the receiver.

For optimum results, the RA.66 should be employed in subdued lighting.

#### 3.2 Preliminary setting

Switch on the equipment by operating the MAINS (POWER) switch on the RA.17 Receiver and the POWER switch on the RA.66 Adaptor.

Set the AE ATTENUATOR (ANT ATTENUATOR) on the RA.17 to MAX and the I.F.GAIN control fully counter-clockwise.

Set the SWEEP TIME switch on the RA.66 to 2.0, the MARKER switch to 100 kc/s and the BANDWIDTH KC/S switch to 8. Set the SPECTRUM CENTRE control to between 4 and 5.

When the trace has appeared, adjust the BRIGHTNESS control for a suitable afterglow and adjust the Y SHIFT control until the 100 kc/s "pips" descend to just above the lower edge of the escutcheon. Adjust the X SHIFT until the trace is set centrally in the escutcheon. Adjust the FOCUS control for a clearly defined display. Adjust the SPECTRUM WIDTH control until eleven 100 kc/s markers (i.e. ten spaces) are visible and are extended completely across the width of the display escutcheon.

#### 3.3 Spectrum selection

Set the AE RANGE (ANT RANGE) control on the RA.17 to WIDEBAND, the AE ATTENUATOR (ANT ATTENUATOR) to MIN, the System switch to MANUAL or A.V.C. as required. The I.F. GAIN control should be moved to its mid-position approximately.

Set the MEGACYCLES dial of the RA.17 to the desired range (e.g. with the Mc/s dial at 10, the range 10 to 11 Mc/s is covered). Adjust the dial accurately for maximum noise-to-signal output at the chosen dial setting.



Set the LOG/LINEAR switch on the RA.66 to LOG. The display covering the entire 1 Mc/s range should now be seen.

Adjust the AE ATTENUATOR (ANT ATTENUATOR) of the RA.17 to provide a display of adequate height which is without distortion or spurious responses.

### 3.4 Display of reduced bandwidths.

Tune the KILOCYCLES scale of the RA.17 to the centre of the required band.

Shift the displayed spectrum by means of the SPECTRUM CENTRE control reducing the SPECTRUM WIDTH as necessary, so that the receiver lies centrally in the escutcheon. Set the MARKER control to RX during this operation.

Adjust the SPECTRUM WIDTH control until the number of 100 kc/s markers visible indicates that the correct spectrum is being displayed. Settings of the SPECTRUM WIDTH control are approximately 7 for a 1 Mc/s width and between 1 and 2 for 100 kc/s.

Check that the spectrum width is correct by shifting the KILOCYCLES scale from end to end of the selected band and noting that the receiver marker moves right across the escutcheon.

### 3.5 The Receiver marker

If it is desired to listen to a signal seen on the RA.66 display the receiver marker should be moved to lie beneath the indication of the trace. The controls of the RA.17 can then be adjusted in the normal way for optimum reception.

The frequency of any displayed signal can be determined accurately by first calibrating the RA.17 KILOCYCLES scale and then reading the frequency from the scale when the receiver marker is correctly aligned on the signal.

### 3.6 Further notes on operation

Further adjustments to the equipment depend upon the requirements of the operator. The following notes on the function of the controls are intended to assist in achieving the desired results.

### 3.6.1 SWEEP TIME SECS switch

For narrow band operation over spectra of the order of 100kc/s a sweep time of 0.2 sec. is suitable. For wider spectra up to 1 Mc/s, a sweep time of 2 sec. should be used.

### 3.6.2 BANDWIDTH KC/S switch

Bandwidths of 1.2, 3.0. and 8.0 kc/s in the signal channel are available. The choice of bandwidth will depend on the signals to be viewed. When a spectrum 1 Mc/s wide is displayed, a signal channel bandwidth of at least 3 kc/s must be employed.

### 3.6.3. LOG/LINEAR switch and R.F. GAIN control

In the LOG position of the switch, the dynamic range of the equipment is of the order 60 to 70 dB. Signals of excessive strength will result in spurious response being displayed. In general, signals less than 1 millivolt at the RA. 17 aerial are not excessive. Should larger signal amplitudes be received, the RA.17 AE ATTENUATOR (ANT ATTENUATOR) should be employed.

With the switch at LINEAR, the R.F.GAIN control on the RA.66 is brought into use. The gain in the signal channel is then wholly dependent on the setting of this control.

### 3.6.4 MARKER switch

This switch has three positions providing the following displays:-

- (1) OFF - No markers
- (2) RX - Receiver marker only
- (3) 100 kc/s - Markers at 100 kc/s intervals only.

Markers are displayed as downward deflections on the base line. If the base line and markers are lost in a crowded spectrum, the Adaptor should be switched to LINEAR and the R.F.GAIN reduced until they re-appear. The location of the markers can be noted and the controls restored to their previous settings for operation.

## SECTION 4

### BRIEF TECHNICAL DESCRIPTION

Reference should be made to the block diagram shown in fig.4.

#### 4.1 R. F. amplifier and first mixer

The output from the RA.17 second mixer, which has a spectrum width from 2.0 - 3.0 Mc/s, is applied to the r.f. amplifier in the RA.66. The gain of this amplifier may be varied by the R.F. GAIN control. The amplifier output is combined in the first mixer with that from the sweep oscillator. The resultant difference frequency is fed to the first i.f. filter.

#### 4.2 Sweep frequency generator

The saw-tooth voltage from the sweep generator, which provides the X deflection for the cathode-ray-tube, is also applied via a cathode-follower reactance modulator to the sweep oscillator covering 3.5-4.5 Mc/s. The oscillator sweeps this band of frequencies at a rate dependent upon the output from the saw-tooth generator. The oscillator output is then applied via a buffer amplifier to the first mixer.

#### 4.3 First i. f. filter and second mixer

The first i. f. filter is a narrow band-pass circuit tuned to 1.5 Mc/s. It will therefore accept signals from the RA.17 second mixer when the output frequency differs from the instantaneous value of the sweep oscillator frequency by 1.5 Mc/s. This results in the successive transmission of all signals in the chosen spectrum as the sweep frequency traverses the band from 3.5 to 4.5 Mc/s.

The output from this filter is fed to the second mixer where it is combined with the 1.4 Mc/s output from the crystal oscillator, thereby providing a second i. f. of 100 kc/s.

#### 4.4 Second i. f. and detector

The second i. f. amplifier is preceded by one of three switched L-C filter circuits providing 8 kc/s, 3 kc/s or 1.2 kc/s bandwidths. The output is rectified in a detector stage.

For logarithmic operation, an a. g. c. voltage derived from the detector stage is applied to the second i. f. amplifier, and for linear operation the cathodes of the r. f. and second i. f. stages are commoned via a manually operated R. F. GAIN control.

#### 4.5 Signal presentation circuits

The d.c. output from the detector is fed via a diode logarithmic video compression circuit to the balanced deflection amplifiers operating the Y plates of the cathode-ray-tube. The compression and a .g.c. circuits can be switched out to enable manual control of the signal amplitude.

#### 4.6 Sweep deflection

The saw-tooth sweep generator also produces the timebase voltage of the X deflection plates of the cathode-ray-tube; voltage is applied via balanced deflection amplifiers.

#### 4.7 Receiver marker circuit

Part of the output from the second v.f.o. in the RA.17 is fed to the third mixer where it is combined with output from the sweep frequency generator. The third i.f. derived from this mixer will only be passed by the band-pass circuits of the third i.f. filter when the difference between sweep frequency and second v.f.o. frequency is approximately 1.4 Mc/s. Any output from the third i.f. filter is passed to the fourth mixer, where it is mixed with the output from the 1.4 Mc/s crystal oscillator.

As the sweep frequency passes through the appropriate values, the output frequency from the fourth mixer will consist of a high frequency beat note, reducing in frequency to zero and then rising once more to a high frequency.

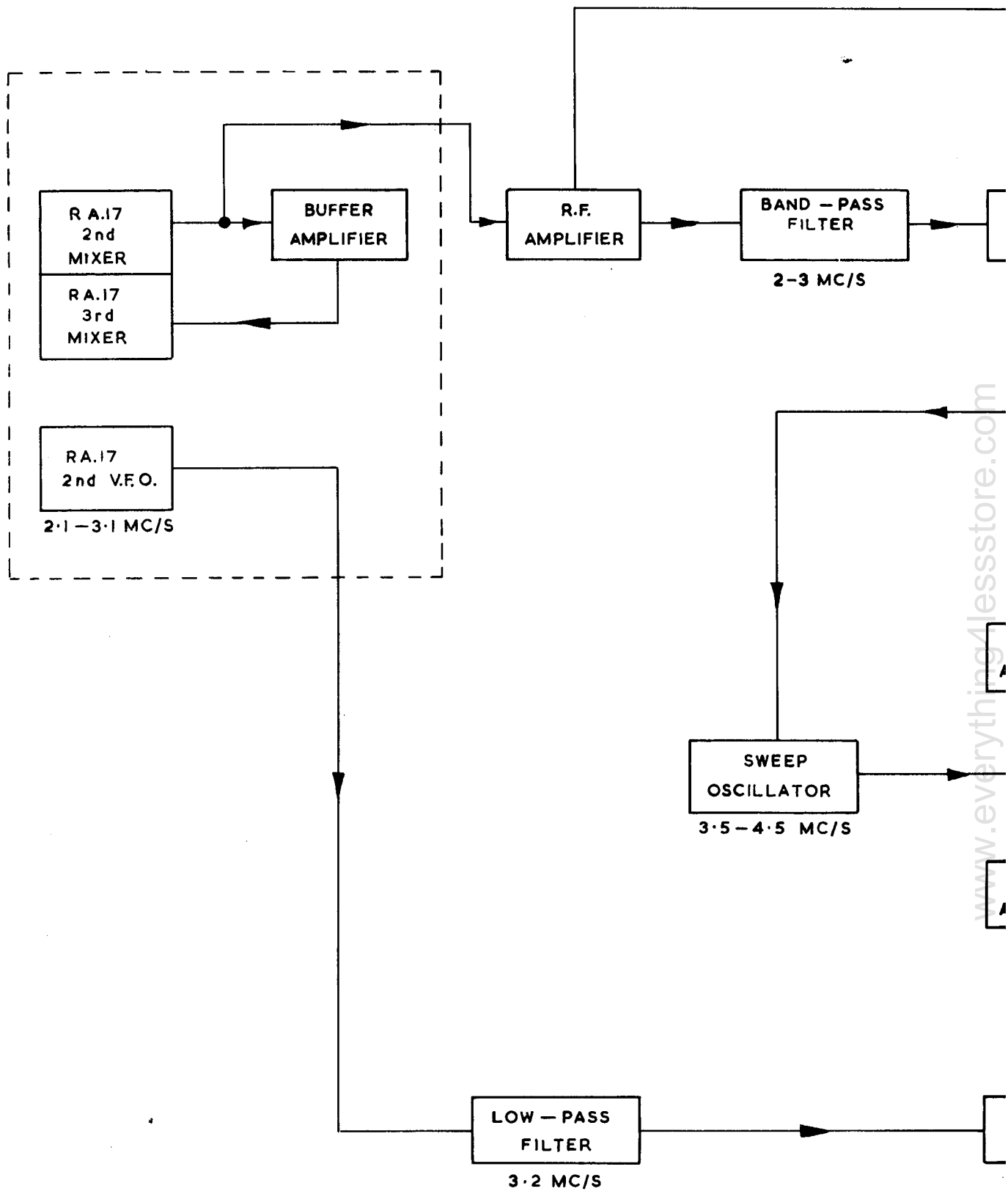
#### 4.8 Marker deflection circuit

The fourth mixer output is fed through a 1500 c/s low-pass filter to a buffer amplifier. Voltage is fed to this amplifier only when the beat note is at 1500 c/s or less. This results in a burst of voltage at the moment the sweep frequency passes the value appropriate to the setting of the second v.f.o. (i.e. the points at which the KILOCYCLES scale of the RA.17 Receiver is tuned). The burst of voltage is applied to a trigger valve acting as a pulse generator and the resulting pulse is fed to the Y plates of the cathode ray-tube. A small downward "pip" in the trace therefore occurs at the moment when the sweep passes the receiver tuning point.

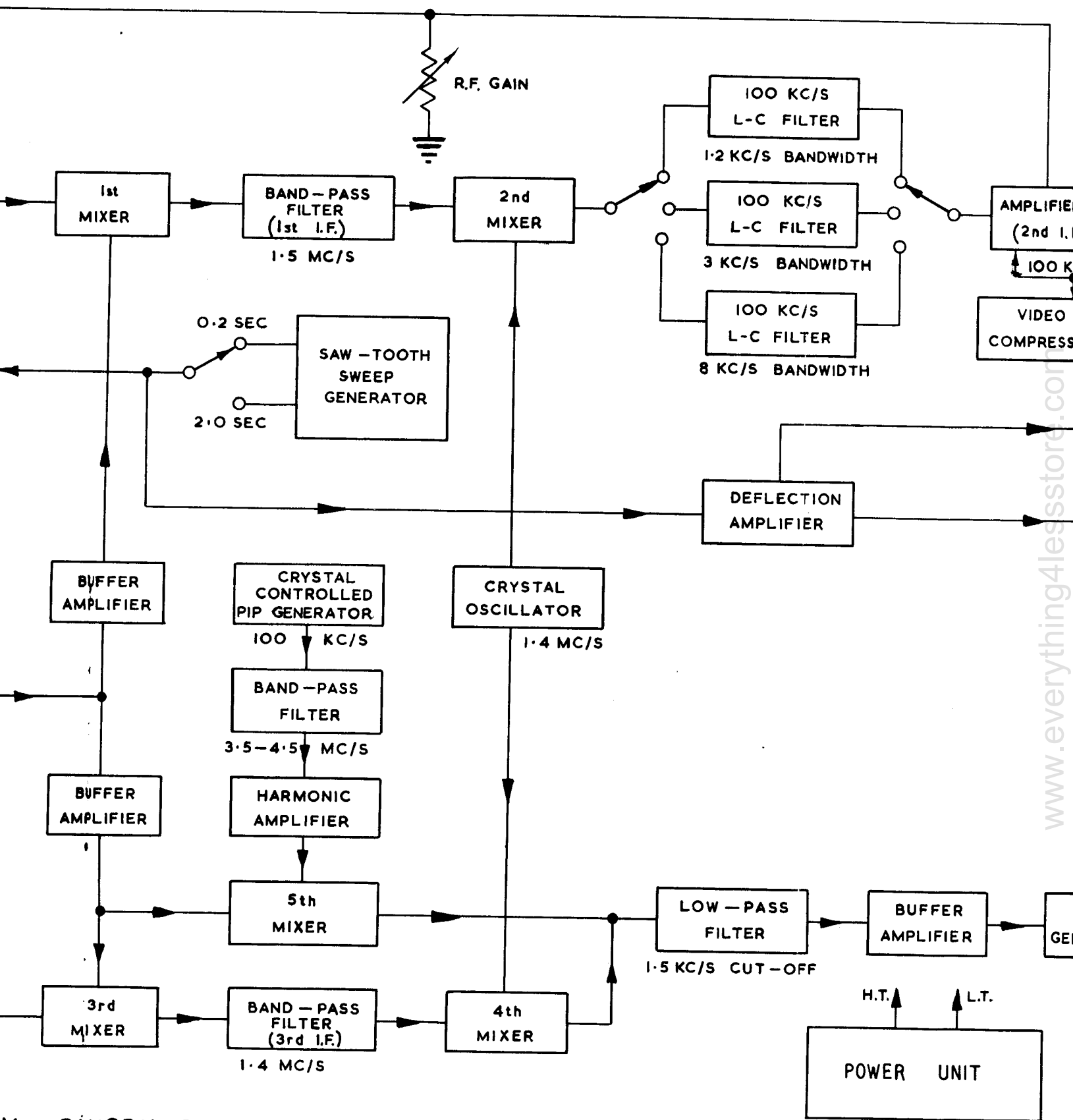
#### 4.9 100 kc/s marker circuits

The output from the crystal controlled 100 kc/s "pip" generator is amplified by a harmonic amplifier which includes 3.5 to 4.5 Mc/s band-pass filter. This filter restricts the available harmonics to the eleven in the range 3.5 to 4.5 Mc/s.

In the fifth mixer, these harmonics are combined with the sweep oscillator frequency. As the sweep frequency passes each harmonic, a beat note occurs in the same way as in the receiver marker circuit. The beat notes are applied to the marker deflection circuit resulting in downward "pips" on the display trace at 100 kc/s intervals.



BLOCK DIAGRAM -



M - PANORAMIC ADAPTOR TYPE RA 66

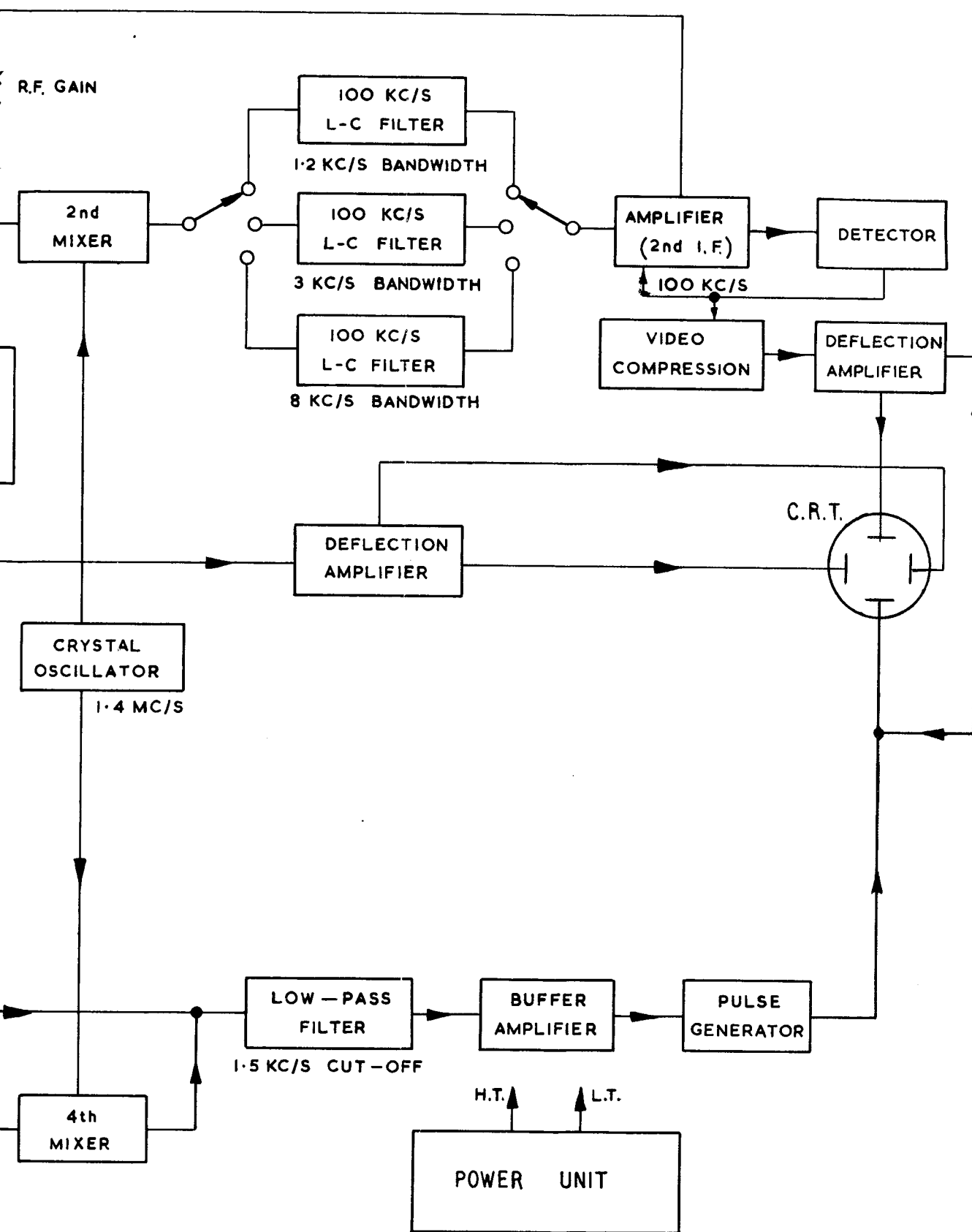


FIG. 4

## SECTION 5

### DETAILED CIRCUIT DESCRIPTION

To simplify understanding the Panoramic Adaptor it should be regarded as two sub-units, namely R.F. Signal Channel and Tuning and Calibration Marker Circuits, plus the power unit.

#### 5.1 Interconnections and input circuits

R.F. connections from the RA.17 are made via coaxial cables to the Signal Channel and Marker Circuits of the Panoramic Adaptor. The cable lengths are not critical, though excessive extension will attenuate the signal spectrum and/or detune the low-pass filter feeding V12. For details of the filter itself see Sect. 5.9.

#### 5.2 R.F. amplifier and first mixer

The r.f. signal channel input consists of a frequency spectrum from the RA.17 second mixer. This covers 2-3 Mc/s regardless of the RA.17 MEGACYCLES and KILOCYCLES dial settings, and is fed at high impedance to the control grid of the r.f. amplifier V1. V1 and V4 are variable-slope pentodes controlled (on linear operations) by the R.F.GAIN control RV1. An r.f. filter is included in the cathode circuit of V1 in order to prevent spurious signals from being fed to the cathode itself; this is adequately decoupled by the capacitor C17.

The output of V1 is developed across a damped and top-inductance coupled circuit (L1) with a substantially flat response over the range 2-3 Mc/s. In order to achieve the required control characteristic, the screen grid is fed via R5 from the +150V stabilized h.t. line and is decoupled by C8.

#### 5.3 Sweep frequency generator and buffer amplifiers

The heterodyne voltage for the first mixer V2 is derived from one (V16) of two buffer amplifiers which are flatly tuned over the range 3.5 to 4.5 Mc/s. Parasitic oscillation of the two amplifiers (V16 and V19) is prevented by the grid stopper resistor R19 and drive is obtained from the cathode-Hartley sweep oscillator V20. The instantaneous operating frequency of V20 is determined by the inductor L17 tuned by the effective value of the capacitor C52 connected in series with R50 across it. Considering V21A as a perfect cathode-follower, its grid and cathode potentials would be equal, the capacitor C52 ineffective and hence L17 would be tuned by its stray capacitance. The value of the tuning capacitance is therefore dependent on the mutual-conductance of V21. This is readily controlled by the grid potential of V21 to which is applied a fraction of the saw-tooth waveform generated by the saw-tooth sweep generator V22.



The amplitude and mean d.c. level of the saw-tooth waveform applied to V21B are determined by a resistive network which includes the front panel controls SPECTRUM CENTRE (RV2) and SPECTRUM WIDTH (RV3, RV4). When varying the amplitude of the saw-tooth voltage (using the SPECTRUM WIDTH control) a change of d.c. level is prevented by backing-off the potentiometer RV3 with another identical one (RV4) which is returned to the negative line. The mean d.c. level of the saw-tooth voltage is determined by RV2 (SPECTRUM CENTRE) which is of a value that is low enough to ensure no interaction between these two controls.

#### 5.4 First i.f. filter and second mixer

The first (V2) and second (V3) mixers are coupled together by the first i.f. bandpass filter; this consists of two double-tuned circuits, top-capacitance coupled by C48, with a response such that the second mixer image rejection is at least 80dB. The filter is tuned to 1.5 Mc/s and will therefore accept signals from the RA.17 second mixer when the output frequency differs from the instantaneous value of the sweep oscillator frequency by 1.5 Mc/s. This results in the successive transmission of all signals in the chosen spectrum as the sweep frequency traverses the band from 3.5 to 4.5 Mc/s. The filter output is then heterodyned against 1.4 Mc/s in the second mixer V3, producing a second i.f. of 100 kc/s.

#### 5.5 1.4 Mc/s crystal oscillator

Adequate injection voltage for the second (V3) and fourth (V13) mixers is developed across L4 and L10 with the capacitive potentiometers C54 C55 and C57 C58 respectively ensuring satisfactory voltage and impedance ratio requirements. L4 and L10 derive their inputs at low impedance from two separate outputs of a 1.4 Mc/s crystal controlled Colpitts oscillator V9, thereby keeping radiation and interaction of the second and fourth mixers to a minimum.

#### 5.6 Second i.f. filter and detector.

The 100 kc/s second i.f. filter provides any one of three switched bandwidths (1.2, 3, 8kc/s) by varying the inductive coupling between four L-C sections. The damping resistors R153 R154, across the second and third sections of this filter, are for use during alignment procedure only. Maximum sensitivity is available when using the 3 kc/s bandwidths; a decrease in sensitivity of approximately 4dB occurs with the other two bandwidths.

An r.f. choke L20, decoupled by C75 prevents the infiltration of r.f. voltages from V3 into the h.t. line.

A variable slope r.f. pentode (V4) provides approximately 40dB of i.f. gain on linear operation (switch SD in LIN position) with the R.F. GAIN control set at the maximum position (section 5.2). On logarithmic operation (switch SD in LOG position), a.g.c. is applied to V4 and this, together with V6, provides the required compression. V6 is biased just to the cut-off position and hence operates over the logarithmic part of its characteristic. In the event of V6 being replaced, the preset potentiometer RV10 can be adjusted to produce the cut-off condition required.

Rectification of the 100 kc/s i.f. is carried out in a balanced detector followed by a conventional R-C filter. The time-constants of this filter and its associated a.g.c. line are somewhat critical, but component values are such that feedback around the a.g.c. loop is prevented while accuracy of signal presentation is maintained.

#### 5.7 Signal presentation

The detector output is fed, either directly or logarithmically compressed, to two deflection amplifiers V7 and V8. These form a paraphase pair, though they are partially unbalanced due to the grid bias conditions of V7 being limited by the compression diode V6. A stabilized h.t. line to the amplifiers is essential in order to prevent change of trace level with variation of h.t.

#### 5.8 Sweep deflection and saw-tooth generator

V10 and V11 form a pair of paraphase amplifiers employing considerable feedback and providing up to 600V deflection voltage at the X plates of the c.r.t. Drive is obtained from the d.c. screen-coupled phantastron V22. Such a circuit is insensitive to changes of h.t. and/or valve parameters, and the anode excursion is maintained within close limits regardless of sweep rate. The sweep times used are 2 sec. and 0.2 sec. since a sweep rate in excess of 500 kc/s will result in ringing the 100 kc/s i.f. filter. Sweep times are determined by selection of either of the resistors R99 or R104 in the grid circuit of V22. Flyback time is considerably reduced by the use of R23, the output impedance of which provides the resistive element of the flyback time-constant. Sweep flyback ratio is of the order of 150:1 and flyback suppression is effected by using a fraction of the negative going pulse at the screen of V22 to bias the c.r.t. grid during the flyback period. The time-constant of the coupling to the c.r.t. grid is made as long as possible and differentiation of the blanking pulse thus kept to a minimum. A silicon diode MR1 in the c.r.t. grid circuit ensures d.c. restoration and thus prevents the "bright-up" which would otherwise occur.

## 5.9 Receiver marker circuits

The second v.f.o. of the RA.17 is always within the range 2.1 to 3.1 Mc/s. A part of its output is fed to the third mixer V12 via a 3.2 Mc/s low-pass filter and resistive potentiometer which :-

- (a) Eliminates harmonics of the second v.f.o.
- (b) Prevents overdrive of the valve. Thus the generation of spurious markers by V12 is ruled out. The low-pass filter consists of a constant-K centre section and two m-derived end sections. This results in a response which is within 3dB from 2.1 to 3.1 Mc/s and 26dB down at 3.3 Mc/s;  $f$  (infinity) is at 3.4 Mc/s.

The third mixer (V12) combines the output from the 3.2 Mc/s low-pass filter with that of the sweep frequency oscillator V20. The resultant difference frequency will only be accepted by the third i.f. filter when the instantaneous difference between sweep oscillator and second v.f.o. frequencies is approximately 1.4 Mc/s. This third i.f. (1.4 Mc/s) is then mixed with 1.4 Mc/s (from the crystal controlled oscillator) in the fourth mixer V13. As the sweep frequency passes the appropriate values, the fourth mixer will produce a high frequency beat-note, reducing in frequency to zero and then increasing once more to some high frequency.

## 5.10 Marker pulse generator and deflection circuits

The resistor R55 forms a common anode load for the fourth (V13) and fifth (V14) mixers, and is also the termination resistor for the pi-section filter (L11, C81, C85) feeding the buffer amplifier V15A. A narrowed band of frequencies from the output of V13 and V14 is therefore applied to the grid of V15A across R70. V15A is a high gain buffer stage which ensures that V15B is driven right through its grid base from a point well beyond cut-off. This operating point is determined by the pre-set potentiometer RV5, and its correct setting results in large constant-amplitude negative-going trigger pulses being available at the anode of V15B. These are used to initiate the actual marker pulses generated by the monostable mult-vibrator V24. Its pulse duration is dependent on the selected grid-to-anode capacitor (C104 or C106) which is isolated by the resistor R90 from the anode circuitry of V15B. The marker pulse is applied to the Y1 plate of the c.r.t. via C122 and C143 thus preventing interaction between the Y amplifiers and V24, and also maintaining an undistorted pulse shape.

### 5.11 100 kc/s marker circuit

The 100 kc/s crystal oscillator V17A feeds a harmonic generator V17B from which the 35th to 45th harmonics are selected by the band-pass filter coupling the harmonic generator to the wideband amplifier V18. Over-coupling of the filter circuits and careful selection of L-C ratio ensures a frequency response within 3dB over the passband. A similar filter in the out-put of V18 limits the available harmonics to the eleven between 3.5 and 4.5 Mc/s. In the fifth mixer, the 100 kc/s harmonics are combined with the appropriate sweep oscillator frequency so that as the sweep progresses, a succession of beat notes are produced (as in para.5.9, V13) and eventually displayed as frequency calibration markers, via V15 and V24, at 100 kc/s intervals along the c.r.t. trace.

### 5.12 Power supplies.

It is essential that the displayed spectrum shall not vary excessively with :-

- (a) Random changes of supply voltage.
- (b) Change of h.t. resulting from operation of controls.
- (c) Change of h.t. with large signal input and its resulting a.g.c. action.

The frequency deviation of V20 must also be linear with respect to time, and hence ripple in its associated circuitry must be kept to a minimum. This has been achieved by the following means:- the use of three stabilized supplies which are unaffected by mains voltage variations of up to  $\pm 6\%$ ; the use of potentiometer feeds in preference to a series arrangement wherever possible; adequate decoupling of all h.t. lines, particularly the signal channel. A large voltage rise as a result of the removal of any of the three VR150 valves (V28, V31, V32) is prevented by the use of jumper connections; the h.t. transformer is protected by a 250mA cartridge fuse FS2. The 110V negative line is derived from a half-wave rectifier V25 followed by a high degree of smoothing and the stabilizer V18. A single 110 V primary winding is used on the e.h.t. transformer, thus keeping its physical size to a minimum. On 200 to 250V operation it is connected in parallel with 110V section of the h.t. transformer primary. For connections see Section 2.1. The e.h.t. source consists of two 1X2A (V29, V30) rectifiers, connected as a voltage-doubler circuit and supplying a conventional potentiometer chain feeding the c.r.t. Astigmatism is made negligible by returning the first and third anodes to + 150V.

Cooling of the whole unit is effected by a multi-bladed fan. This is driven by a single-phase shaded-pole induction motor permanently connected across the 110V transformer windings. Further protection of the unit is provided by the 3 amp. power fuse FSI and the double-pole POWER ON/OFF switch SD.

## PART 2

### MAINTENANCE INSTRUCTIONS

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## SECTION 1

### TEST EQUIPMENT

CAUTION: THERE ARE DANGEROUS VOLTAGES PRESENT IN THIS INSTRUMENT AND CARE SHOULD BE TAKEN WHEN MAKING MEASUREMENTS.

- (1) Valve millivolt meter reading up to 10 volts at frequencies up to 5 Mc/s (Philips Type GM.6014).
- (2) Signal generator covering 100 kc/s to 6 Mc/s with an output from  $1\mu\text{V}$  to 1 volt (Marconi Type TF.144G).
- (3) Oscilloscope (Solartron Type CD.513).
- (4) Frequency meter measuring up to 100kc/s (Racal Type SA.20).
- (5) Multi-range meter, 20 000 ohms per volt, and reading up to 5 kV.
- (6) The following components:  $0.1\mu\text{F}$  capacitor,  $4.7\text{k}\Omega \frac{1}{4}\text{W}$  resistor and  $470\Omega$  resistor.

## SECTION 2

### VALVE DATA

#### 2.1 Base connections

Type 6AU6 6BA6 6AS6 12AT7 1X2A VR.150/30 5V4 6X4 6AL5 D.P1622

Base B7G B7G B7G B9A B9A I.O I.O B7G B7G B14A

Pin No.

1	G1	G1	G1	A2	Hs	-	-	A2	K1	H
2	G3	G3	K	G2	H	K	H	-	A2	K
3	H	H	H	K2	-	J	-	H	H	G
4	H	H	H	H	Hs	-	A2	H	H	A2
5	A	A	A	H	H	A	-	-	K2	-
6	G2	G2	G2	A1	Hs	-	A1	A1	S	SCR
7	K	K	G3	G1	-	J	-	K	A1	Y1
8				K1	H	-	H/K			Y2
9				H	Hs					A3
10				C. T.	A (Top Cap)					X2
11										X1
12										-
13										A1
14										H



## 2.2 Representative Working Voltages

Heterodyne injection levels are measured as follows and with the valve removed:-

- (1) Pin 1 of V2: 3.5 volts;
- (2) Pin 7 of V3: 5 volts;
- (3) Pin 7 of V12: 3 volts;
- (4) Pin 7 of V13: 8 volts;
- (5) Pin 1 of V14: 3 volts.

Inputs to pin 1 of V16 and V19: 0.5 volt r.m.s. (V19 removed).

The d.c. potential at the junction of L23 and C116 is approximately 390 volts.

The d.c. potentials shown in the following table should be taken as representative values only. The conditions of measurement, with no signal input, are as follows:-

R.F.GAIN to maximum;  
BANDWIDTH to 3 KC/S;  
SPECTRUM WIDTH to maximum;  
SPECTRUM CENTRE to mid- position.

Cct. Ref.	1	2	3	4	Pin No.				
					5	6	7	8	9
V1(6BA6).					240	80	1.25		
V2(6BE6)		1.95			156	88			
V3(6AS6)		1.8			165	120	0.48		
V4(6BA6)		0.85			250	65	0.85		
V5(6AL5)		-0.34					-0.34		
V6(6AL5)									
V7(6AU6)		0.55			110	56	0.55	) Trace in normal	
V8(6AU6)		0.34			174	56	0.34	) Working position	
V9(6AU6)					220	100	2.3		
V10(6AU6)						150	) See		
V11(6AU6)						150	) Fig. 6		
V12(6AS6)		3.0			150	125			
V13(6AS6)		0.84			90	55			
V14(6AS6)		0.9			90	55			
V15(12AT7)24						150			
V16(6AU6)		1.5			245	130	1.5		

Cct. Ref.	1	2	3	4	5	6	7	8	9	T.C.
V17(12AT7)	145					115				
V18(6AU6)		0.85			135	85	0.85			
V19(6AU6)		1.35			220	120	1.35			
V20(6AS6)					130	50				
V21(12AT7)	140		3.05			140		3.05		
V22(6AU6)								See Fig. 6		
V23(6AU6)					250	250				
V24(12AT7)	90					260				
V25(6X4)	-330					-330	350			
							(a.c.)			
V26(5V4G)		H		350		350		375	(H - H: 5V a.c.)	
				(a.c.)		(a.c.)		H		
V27	Omitted									
V28(VR150/30)		-150	-150		E		-150			
V29(1X2B)										4400
V30(1X2B)										
V31(VR150/30)		150	300		300		300			
V32(VR150/30)		E	150		150		150			
V33(DP.16-22)	2900			2500		150			150	

The smoothed e.h.t. voltage across C119 is approximately 3000 volts.

Note: The oscillograms shown in fig. 6 should be taken only as representative results.

## SECTION 3

### REPRESENTATIVE TEST DATA

#### 3.1 Spurious Responses

Provided that the recommended maximum input level (60dB above  $3\mu\text{V}$ ) at the SIGNAL SPECTRUM INPUT socket is not exceeded, spurious signal responses are not less than -66dB. The correct setting for the bias on V15B (RV5) ensures that spurious marker pulses do not trigger V24 and hence do not appear on the display spectrum.

A spurious signal, 100kc/s in advance of the tuning marker, may be evident and is the result of break-through from the 2nd v.f.o. into the h.t. line to PL7 (fig.5) and thus into the signal channel of the RA.66.

#### 3.2 Sensitivity and Stage Gain

Unless otherwise stated, the following tests are carried out with the LOG/LIN switch in the LINEAR position, the R.F.GAIN control at maximum the BANDWIDTH switch at 3KC/S and the input signal derived from the direct terminal of the signal generator Type TF.144G; the sweep rate equals 500 kc/s. The input signal for a 1 in. deflection is  $12\mu\text{V}$  r.m.s.

##### 3.2.1 Typical sensitivity values in the range 2 - 3 Mc/s.

Amplitude of input signal =  $10\mu\text{V}$  r.m.s.

f(Mc/s)	2	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Deflection (mm.)	20	21	22	23	22	21	22	23	23	22	21

##### 3.2.2 2 - 3 Mc/s r.f. amplifier

With 1 volt r.m.s. at 2.5Mc/s into grid 1 (pin 1) of V2 valveholder (V2 removed), the stage gain is 20 to 22 dB.

##### 3.2.3 1.5Mc/s mixer (1st.)

The conversion gain is approximately 16 dB under the following conditions: (see also Sect.4)

1. V20 is removed and 0.5 volt r.m.s at 4Mc/s is injected into grid 1 (pin 1) of V16;
2. The amplitude of a 2.5 Mc/s signal into grid 1 (pin1) of V2 is adjusted to produce 1 volt r.m.s. at grid 1 (pin1) of V3 valveholder with V3 removed.

#### 3.2.4 100kc/s mixer (2nd.)

The conversion gain is approximately 22 - 24dB under the following conditions: the amplitude of a 1.5Mc/s signal into grid 1 (pin 1) of V3 is adjusted to produce 1 volt r.m.s. at grid 1 (pin 1) of V4 valveholder with V4 removed.

#### 3.2.5 100kc/s amplified (2nd i.f.)

The gain is approximately 38 - 40dB that is, 20mV r.m.s. at 100 kc/s into grid 1 (pin 1) of V4 produces 1 volt d.c. at grid 1 (pin 1) of V7 valveholder.

#### 3.2.6 Y ampl' fier

A change of 1 volt d.c. at grid 1 (pin 1) of V7 results in an 80-volt change in the anode potentials of V7 and V8 that is, approximately 38dB per valve.

#### 3.2.7 2 - 3Mc/s band-pass filter

The response is within  $\pm 2$ dB throughout the passband.

#### 3.2.8 3.5 - 4.5Mc/s band-pass filter

The response is within 3dB throughout the passband.

#### 3.2.9 3.1Mc/s low-pass filter

The response varies by not greater than 3dB within the band of 2.1 to 3.1 Mc/s; it is 26dB down at 3.3Mc/s with no rebounds above -26dB.  $f(\infty)$  equals 3.4Mc/s.

#### 3.2.10 2kc/s low-pass filter

The response is within  $\pm 3$ dB in the range of 5c/s to 2.2 kc/s; above 2.2kc/s, there is attenuation at the rate of 18dB per octave.

## SECTION 4

### ALIGNMENT PROCEDURE

#### 4.1 Preliminary Checks

CAUTION: THERE ARE DANGEROUS VOLTAGES PRESENT IN THIS INSTRUMENT AND CARE SHOULD BE TAKEN WHEN MAKING MEASUREMENTS.

Check the fuses and also the settings of the taps on the primary winding of the mains transformer - refer to Part 1, Sect. 2.1

Switch on the equipment and check all voltages produced by the power unit, that is :- (refer to fig.9)

1. +350 volts d.c. unstabilized; (point A)
2. +300 volts d.c. unstabilized; (point B)
3. +260 volts d.c. unstabilized; (point C)
4. +300 volts d.c. stabilized; (point D)
5. +150 volts d.c. stabilized; (point E)
6. 110 volts d.c. stabilized; (point F)
7. One 5-volt and three 6.3-volt windings on T2: note that the 6.3-volt, 0.6-amp. winding is above earth potential.
8. One 6.3-volt and one 1.25-volt winding on T1: note that each winding is above earth potential and care should be taken when making measurements.

#### 4.2 C.R.T. Display

Set the MARKER control to OFF and the R.F.GAIN control to the fully counter-clockwise position. Centralize the trace with the X and Y SHIFT controls. Adjust the FOCUS and BRIGHTNESS controls for optimum display conditions. With the SWEEP TIME SECS. switch in either position, the X-deflection should be the same length for both positions of the switch. Ensure that adequate X-sweep is available by turning the expansion control (RV8) to maximum, then adjust this control until the trace extends to just beyond the edges of the tube.

Note: Access to RV8 is obtained by slightly withdrawing the front panel and chassis from the cabinet; the preset control is situated behind the panel on the chassis and to the right of the c.r.t.

Flyback should not be visible, though this is checked more reliably when the signal spectrum is present on the display. If flyback suppression is ineffective, check the silicon diode for forward/reverse impedance ratio.

#### 4.3 Sweep Oscillators

Short the wipers of the ganged potentiometers RV3 and RV4 (SPECTRUM WIDTH) to chassis and adjust the core of L17 until V20 oscillates at approximately 3.8Mc/s.

Remove the shorting link and ensure that V20 oscillates over not less than 3.45 to 4.55Mc/s with the SPECTRUM WIDTH control fully clockwise and the SPECTRUM CENTRE control at approximately mid-position. Also ensure that less than 95kc/s sweep can be obtained in any part of the 3.5 to 4.5 Mc/s spectrum by turning the SPECTRUM WIDTH control to the fully counter-clockwise position and then adjusting the SPECTRUM CENTRE control.

Note: The oscillation frequency of V20 can be monitored with the RA.17 receiver using a loosely coupled pick-up coil in close proximity to the valve.

#### 4.4 Diode Bias (V6)

Set RV10 (situated between V6 and V7) to the maximum bias condition for V6, and position the trace in the centre (approx.) of the c.r.t. screen.

Operate the LOG/LIN switch and note, for each position of the switch, the amount by which the trace moves along the Y-axis; now adjust RV10 until the trace movement is reduced to zero.

#### 4.5 100kc/s Transformer (L5)

Switch to LINEAR operation and turn the R.F.GAIN control to the fully clockwise position. Set the trimmers on L5 to an approximately half-mesh position. Damp the primary circuit of L5 with a 0.1 $\mu$ F capacitor and a 4.7k resistor connected in series; tune the secondary of L5 for maximum output with an input to grid 1 (pin 1) of V4 of 0.5 volt r.m.s. at 100 kc/s (use the SA.20 Frequency Meter to check this frequency).

Transfer the damping components to the secondary winding and tune the primary for maximum output; use the Y deflection of the trace as an indicator.

#### 4.6 100kc/s L-C Filter

This will be pre-aligned as a sub-unit; the alignment can be carried out in the main unit as follows:

Remove V9 and align the 100kc/s transformer as in Sect.4.5

Inject approximately 0.5 volt r.m.s. at 100kc/s into grid 1 (pin 1) of V3, set the BANDWIDTH switch to the 1.2KC/s position, and adjust all four trimmers for maximum output. Re-check as necessary and replace V9.

Note: During this alignment procedure, reduce the input in order to avoid overdriving V4.

#### 4.7 1.4Mc/s Oscillator (V9)

Remove V3 and V13. Peak the response of L4 and L10 with the valve millivolt meter connected, in turn, to pin 7 of the valveholders of V3 and V13. Replace V13 ONLY

#### 4.8 First I.F. Filter (L2 and L3)

Remove V9 and V20 and set the 0.7 to 3.7pF trimmer (C48) to an approximately half-mesh position. Inject approximately 0.5 volt r.m.s. at 1.5Mc/s into grid 1 (pin 1) of V2 and tune both the primary and secondary windings of L2 and L3 for a maximum indication on the valve millivolt meter connected to grid 1 of V3 valveholder.

After having completed the remainder of the alignment procedure, re-adjust C48 and re-tune L2 and L3 until a 12uV input signal at 2.5Mc/s on grid 1 (pin 1) of V2 produces a 1 in. deflection with LINEAR operation; the BANDWIDTH and SWEEP TIME SECS. controls should be set to 3KC/S and 2 respectively.

#### 4.9 2 -3Mc/s Amplifier (V1)

Replace V3 and V9.

Remove V2 and connect the valve millivolt meter to pin 7 on the valveholder of V2; disconnect the coupling coil L18 and the twisted-wire capacitor across L18.

Inject approximately 0.5 volt r.m.s. at 2.1 Mc/s into grid 1 (pin 1) of V1 and tune the primary and secondary windings of L1 for maximum output.

Re-connect the coupling components and adjust the twisted-wire capacitor for maximum rejection at 5Mc/s.

The response at 5Mc/s should be not less than -50dB and that at 6Mc/s not less than -38dB.

Note: The twisted wire capacitor is adjusted by tightening or loosening the mechanical coupling between the turns.

#### 4.10 Buffer Amplifier (V16 and V19)

Connect the valve millivolt meter to pin <sup>1</sup> on the valveholder of V2 (already removed). Damp the primary of L12 with a  $0.1\mu\text{F}$  capacitor and a  $470\Omega$  resistor connected in series.

Inject approximately 0.5 volt r.m.s. at 3.9 Mc/s into grid 1 (pin 1) of V19, and tune the secondary of L12 for maximum output.

Transfer the damping components to the secondary winding of L12 and tune the primary for maximum output.

Replace V2 and remove V12, then align L16 in a similar manner, monitoring at grid 3 (pin 7) of V14.

#### 4.11 100kc/s Harmonic Generator (V17)

Set the MARKER switch to the 100KC/S position. Connect the valve millivolt meter to pin 1 of the valveholder of V14, and remove the 100kc/s crystal.

Inject a 3.9Mc/s signal into grid 1 (pin 1) of V18 and align L15 as for L12 and L16 in Sect. 4.10.

Transfer the damping components ( $0.1\mu\text{F}$  and  $470\Omega$ ) to L14 and the signal source to grid 1 (pin 2) of V17B. Align L14 as for L15 (or L12) reducing the input as required in order to keep the meter indicator at grid 1 or V14 to approximately 0.5 volt r.m.s.

Remove the damping components and the signal source, replace the 100kc/s crystal, and commencing with the core fully out, tune L13 for maximum output while monitoring at grid 1 or V17B. Back-off the core by one turn, remove the valve millivolt meter and replace V14.

#### 4.12 Tuning Marker Mixer (V12) and 3.1Mc/s Filter

Set the MARKER switch to RX. Remove V13 and V20; connect the valve millivolt meter to pin 1 of V13 valveholder.

Inject approximately 0.5 volt r.m.s. at 1.5Mc/s into the 2ND. V.F.O. INPUT socket, and peak the response of the primary and secondary windings of L9 for maximum output.

Replace V13, remove V12 and connect the millivolt meter to pin 1 on the valveholder of V12.

Adjust the core settings of L6, L7 and L8 for maximum attenuation at 4Mc/s.



Remove the signal source and replace V12 and V20.

Note: Adjustments to L6, L7 and L8 are simplified by lifting the c.r.t. clear of its mounting brackets.

#### 4.13 Bias Adjustment to V15B Calibration and Tuning Marker Checks.

Set RV5 to the fully clockwise position.

Adjust the SPECTRUM WIDTH AND SPECTRUM CENTRE controls so that V20 is swept from 3.45 to 4.55Mc/s.

Note: Access to RV5 is obtained by slightly withdrawing the front panel and chassis from the cabinet; the preset control is situated behind the panel on the chassis and to the left of the c.r.t.

Set the MARKER switch to the 100KC/S position and the SWEEP TIME SECS. switch to the 2.0 position.

Advance the position of RV5 until eleven 100kc/s markers only are displayed on the c.r.t. Excess bias will result in intermittent display of the markers, whilst insufficient bias will allow spurious calibration markers to be accepted by V15B and hence presented on the display spectrum.

With a 2.1Mc/s and 3.1Mc/s input to the receiver marker channel, the position of the receiver markers thus produced should coincide with the first and last calibration markers respectively. Adjust RV13 (adjacent to V12) so that one tuning marker only is produced; excess input will cause spurious markers.

#### 4.14 Linearization of the Calibration Marker Display

Should examination of the display reveal unequal settings of the first two and the last two calibration markers, re-adjust L17 for optimum results, countering the change of frequency by resetting the position of the SPECTRUM CENTRE control. However, it must still be possible to fulfil the requirements of Sect.4.3

## SECTION 5

### FAULT DIAGNOSIS

#### 5.1 Introduction

The nature of the display on the cathode-ray-tube of the RA.66 forms a convenient means for locating fundamental faults that may develop. The following information, together with a reference to the Section Number quoted, will provide an aid to the process of fault diagnosis; representative test and valve data are contained within Sections 2 and 3.

#### 5.2 Initial Procedure

1. If the pilot lamp fails to glow and there is no c.r.t. display, check the main fuse.
2. If the pilot lamp glows but there is no c.r.t. display, check the following: the h.t. fuse F2 (250 mA), the h.t. (V26) and e.h.t. (V29 and V30) rectifiers, the Y-amplifier (V7 and V8). (Refer to Part 1, Sect. 5.7 and Part 2, Sect.4.4)

#### 5.3 Fundamental Display Faults

Note: Reference should be made to Part 1, Sect. 5.8 and Part 2, Sect. 4.2.

1. Movement of the trace along the Y-axis occurs when operating the LOG/LIN switch; check the setting of RV10 in accordance with Sect. 4.4.
2. The spot is hard over to either side of the c.r.t.; check the operation of V22 and/or V23.
3. Only one half of the trace length exists; check the operation of V10 and V11.
4. Insufficient sweep amplitude; check the adjustment of the expansion control RV8. It is possible, after some considerable period of usage, that V10 and V11 must be replaced due to a falling off in emission.
5. The trace length changes with operation of the SWEEP TIME switch; check the inter-electrode capacitance between grids 2 and 3 of V22.
6. The sweep times (0.2 and 2 sec.) appear to be incorrect; check the values of C110, R99, R104A and R104. Also check the operation of V22.
7. There is no fly-back suppression; check the characteristic of the silicon diode MR1.

#### 5.4 General Procedure

1. There is excess noise when the calibration markers are switched on; check the capacitor C78.
2. Calibration markers only can be obtained; check the operation of V9 (Refer to Part 1, Sect. 5.5 and Part 2, Sect. 4.7).
3. There are no calibration or signal markers; check the operation of V20 and V21, and also the settings of the SPECTRUM WIDTH and SPECTRUM CENTRE controls (Refer to Part 1, Sect. 5.3 and Part 2, Sect. 4.3).
4. Faulty signal display with logarithmic operation:-
  - (1) No signals; check the a.g.c. line and the setting of RV10 (refer to Sect. 4.4).
  - (2) Insufficient dynamic range or non-logarithmic operation; check the setting of RV10 (Sect. 4.4) and overall gain of V1, V2 and V3 (Sect. 4.8).
  - (3) Spurious signals are present; check the a.g.c. de-coupling and the cathode choke (L19) of V1.
5. Faulty signal display with linear operation:-
  - (1) No signals; Check the operation of the valves V1 to V5 and V16.
  - (2) Loss of gain with a 1.2kc/s bandwidth; check the 100kc/s filter (refer to Sect. 4.6).
  - (3) Spurious signals are present; refer to Sect. 3.2.
6. Faulty display of Receiver (signal) marker and calibration markers; check the operation of V15, V24 and V19.
  - (1) Faulty calibration markers:
    - (a) No markers; check the operation of V14, V17 and V18 (refer to Part 1, Sect. 5.11).
    - (b) Intermittent display of markers; check the setting of RV5 (refer to Sect. 4.13); also check the operation of 100kc/s crystal oscillator V17 (refer to Sect. 4.11).
    - (c) Non-linear spacing of the markers; check the setting of L17 (refer to Sect. 4.14).
    - (d) Spurious markers are present; check the setting of RV5 (refer to Sect. 4.13).
  - (2) Faulty receiver tuning marker:
    - (a) No marker; check the operation of V12 and V13 (refer to Part 1, Sect. 5.9 and Part 2, Sect. 4.12).
    - (b) Intermittent display of markers; check the setting of RV5 and of RV13 (refer to Sect. 4.13).
    - (c) Spurious markers are present; check the settings of L6, L7, L8 and RV13 (refer to Part 1, Sect. 5.9 and Part 2, Sect. 4.12 and 4.13).

<u>Cct Ref</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol</u>	<u>Manufacturer and Type or Drawing No.</u>	
<u>RESISTORS</u>						
R1	47k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R2	47k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R3	10k $\Omega$	Carbon	1/8W	10%	Erie	16
R4	10k $\Omega$	Carbon	1/8W	10%	Erie	16
R5	33k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R6	470k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R7	2.2k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R8	2.2k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R9	180 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R10	180 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R11	10k $\Omega$	Carbon	1/8W	10%	Erie	16
R12		DELETED				
R13	4.7k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R14		DELETED				
R15	68 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R16	10k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R17	10k $\Omega$	Carbon	$\frac{1}{4}$ W	10%	Erie	9
R18	10k $\Omega$	Carbon	1/8W	10%	Erie	16
R19	1k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R20	22k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R21	680 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R22	100k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R23	10k $\Omega$	Carbon	1/8W	10%	Erie	16
R24	100k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R25	470k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R26	12k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R27	10k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R28	470 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R29	15k $\Omega$	Carbon	1W	10%	Erie	10
R30	10k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R31	1M $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R32	270 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R33	68k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie	8
R34	47k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9
R35	1k $\Omega$	Carbon	$\frac{1}{4}$ W	10%	Erie	9
R36	150k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie	9

<u>Cct.</u> <u>Ref.</u>	<u>V lue</u>	<u>Description</u>	<u>Rating</u>	<u>Tol</u>	<u>Manufacturer and</u> <u>Type or Drawing No.</u>
R37	330Ω	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R38	1kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R39	470Ω	"	$\frac{1}{4}$ W	5%	Erie 9
R40	180Ω	"	$\frac{1}{4}$ W	5%	Erie 9
R41	470Ω	"	$\frac{1}{4}$ W	5%	Erie 9
R42	6.8kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R43	10kΩ	"	1 W	5%	Erie 10
R44	10kΩ	"	1/8 W	10%	Erie 16
R45	1kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R46	220kΩ	"	$\frac{1}{4}$ W	10%	Erie 9
R47	150kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R48	120kΩ	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R49	4.7kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R50	1kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R51	68kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R52	15kΩ	"	1 W	10%	Erie 10
R53	270Ω	"	$\frac{1}{4}$ W	5%	Erie 9
R54	22kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R55	27kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R56	12kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R57		DELETED			
R58	330Ω	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R59	10kΩ	"	1/8 W	10%	Erie 16
R60	18kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R61	15kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R62	470Ω	"	$\frac{1}{2}$ W	5%	Erie 8
R63	1.2kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R64	15kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R65	47kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R66	1MΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R67	10kΩ	"	1/8 W	10%	Erie 16
R68	3.3kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R69	10kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R70	27kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R71	2.2kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R72	56kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R73	56kΩ	"	$\frac{1}{4}$ W	5%	Erie 9
R74	10kΩ	"	1 W	5%	Erie 8
R75	2.2kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R76	470kΩ	"	$\frac{1}{2}$ W	5%	Erie 8
R77	220Ω	"	$\frac{1}{4}$ W	5%	Erie 9

<u>Cct. Ref.</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol.</u>	<u>Manufacturer and Type or Drawing No.</u>
R78	10M $\Omega$	Carbon	$\frac{1}{2}$ W	10%	Erie 8
R79	10M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R80	11M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R81	3.3k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R82	68 $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R83	100k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R84	10k $\Omega$	"	$\frac{1}{8}$ W	10%	Erie 16
R85	100k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R86	82k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R87	15k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R88	100k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R89		DELETED			
R90	1M $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R91	100k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R92	4.7M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R93	100k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R94	270k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R95	18k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R96	18k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R97	220k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R98	33k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R99	1.5M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R100	33k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R101	47k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R102	100k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R103	1M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R104	10M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R104A	4.7M $\Omega$	"	$\frac{1}{2}$ W	10%	Erie 8
R105	15k $\Omega$	Wire Wound	7W	5%	Painton P. 302
R106	820k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie 8
R107	2.2M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R108	100k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R109	82k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R110	470k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R111	1M $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R112	1M $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R113	4.5k $\Omega$	"	1W	5%	Erie 10
R114	3.5k $\Omega$	Wire Wound	7W	5%	Painton P. 302
R115	1M $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R116	270 $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R117	470k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R118	4.7M $\Omega$	"	$\frac{1}{2}$ W	10%	Erie 8

<u>Cct. Ref.</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol.</u>	<u>Manufacturer and Type or Drawing No.</u>
R119	470k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R120	3k $\Omega$	Wire Wound	$3\frac{1}{2}$ W	5%	Painton P.306
R121	7k $\Omega$	"	7 W	5%	Painton P.302
R122	220k $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R123	220k $\Omega$	"	$\frac{1}{4}$ W	10%	Erie 9
R124	1M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R125	56k $\Omega$	"	1 W	10%	Erie 10
R126	2.5k $\Omega$	Wire Wound	7 W	5%	Painton P.302
R127	18k $\Omega$	"	7 W	5%	Painton P.302
R128	82k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie 8
R129	1M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R130	22k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R131	1k $\Omega$	Wire Wound	6 W	5%	Painton P. 305
R132	270 $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R133	330k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R134	56k $\Omega$	"	1 W	10%	Erie 10
R135	470k $\Omega$	"	1 W	10%	Erie 10
R136	1M $\Omega$	"	1 W	5%	Erie 10
R137	1M $\Omega$	"	1 W	5%	Erie 10
R138	1M $\Omega$	"	1 W	5%	Erie 10
R139	1M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R140	330k $\Omega$	"	$\frac{1}{2}$ W	5%	Erie 8
R141	4.5k $\Omega$	Wire Wound	6 W	5%	Painton P 305
R142	15k $\Omega$	Carbon	$\frac{1}{2}$ W	5%	Erie 8
R143	10M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R144	56k $\Omega$	"	1 W	10%	Erie 10
R145	1.2M $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R146	1M $\Omega$	"	1 W	5%	Erie 10
R146A	1M $\Omega$	Carbon	1 W	5%	Erie 10
R147	2k $\Omega$	Wire Wound	6 W	5%	Painton P. 305
R148	25 $\Omega$	"	5 W	5%	Painton P. 301
R149	180 $\Omega$	"	7 W	5%	Painton P. 302
R150	15k $\Omega$	"	7 W	5%	Painton P. 302
R151	1M $\Omega$	Carbon	$\frac{1}{4}$ W	5%	Erie 9
R152	680k $\Omega$	"	1 W	5%	Erie 10
R153	470k $\Omega$	"	$\frac{1}{4}$ W	10%	Erie 9
R154	470k $\Omega$	"	$\frac{1}{4}$ W	10%	Erie 9
R155	22 $\Omega$	"	$\frac{1}{4}$ W	10%	Erie 9
R156	68 $\Omega$	"	$\frac{1}{4}$ W	10%	Erie 9
R157	150 $\Omega$	"	$\frac{1}{4}$ W	10%	Erie 9
R158	220k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9
R159	220k $\Omega$	"	$\frac{1}{4}$ W	5%	Erie 9

<u>Cct.</u> <u>Ref.</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol.</u>	<u>Manufacturer and</u> <u>Type or Drawing No.</u>
<u>CAPACITORS</u>					
C1	56pF	Silver Mica	350V	5%	LEM 1106R. ins.
C2		DELETED			
C3	0.01μF	Tubular paper	400V	20%	Hunt W97/BM21K
C3A	0.01μF	" "	400V	20%	Hunt W97/BM21K
C4	0.01μF	" "	400V	20%	Hunt W97/BM21K
C5	82pF	Silver mica	350V	5%	LEM 1106R. ins.
C6	0.01μF	Tubular paper	400V	20%	Hunt W97/BM21K
C7	0.01μF	" "	400V	20%	Hunt W97/BM21K
C8	0.01μF	" "	150V	20%	Hunt W97/BM13K
C9	32μF+32μF	Electrolytic	450V	-	Hunt KBC564
C10	82pF	Silver mica	350V	5%	LEM. 1106R. ins.
C11	0.01μF	Tubular paper	150V	20%	Hunt W97/BM13K
C12	0.01μF	" "	150V	20%	Hunt W97/BM13K
C13	0.01μF	" "	400V	20%	Hunt W97/BM21K
C13A	1000pF	Silvered ceramic	750V	20%	FEC 310K
C14	56pF	Silver mica	350V	5%	LEM. 1106R. ins.
C15	33pF	" "	350V	2%	LEM. 1106R. ins.
C16	33pF	" "	350V	2%	LEM. 1106R. ins.
C17	0.01μF	Tubular paper	150V	20%	Hunt W97/BM13K
C18	15pF	Silver mica	350V	2%	LEM. 1106R. ins.
C19	15pF	" "	350V	2%	LEM. 1106R. ins.
C20	27pF	" "	350V	2%	LEM. 1106R. ins.
C21	0.1μF	Tubular paper	350V	20%	Hunt W49/B512AK
C22	22pF	Silver mica	350V	2%	LEM. 1106R. ins.
C23	22pF	" "	350V	2%	LEM. 1106R. ins.
C24	1000 pF	Silver ceramic	750V	20%	FEC 310K
C25	0.01μF	Tubular paper	400V	20%	Hunt W97/BM21K
C26	270pF	Silver mica	350V	2%	LEM. 1106R. ins.
C27	0.01μF	Tubular paper	150V	20%	Hunt W97/BM13K
C28		SEE C9			
C29	22pF	Silver mica	350V	2%	LEM. 1106R. ins.
C30	220pF	" "	350V	2%	LEM. 1106R. ins.
C31	0.01μF	Tubular paper	150V	20%	Hunt W97/BM13K
C32	0.01μF	" "	400V	20%	Hunt W97/BM13K
C33	270pF	Silver mica	350V	2%	LEM. 1106R. ins.
C34	0.01μF	Tubular paper	400V	20%	Hunt W97/BM21K
C35	82pF	Silver mica	350V	5%	LEM. 1106R. ins.
C36	47pF	" "	350V	2%	LEM. 1106R. ins.
C37	120pF	" "	350V	5%	LEM. 1106R. ins.



Cct.					Manufacturer and
Ref.	Value	Description	Rating	Tol.	Type or Drawing No.
C38	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C39	0.01 $\mu$ F	" "	150V	20%	Hunt W97/BM21K
C40	25 $\mu$ F	Electrolytic	12V	-	Hunt L28/1, JD26T, 85°C
C41	220pF	Silvered mica	350V	2%	LEM. 1510E. ins.
C42	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C43	68pF	Silver mica	350V	2%	LEM. 1106R. ins.
C44	68pF	" "	350V	2%	LEM. 1106R. ins.
C45	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C46	130pF	Silver mica	350V	2%	LEM. 1106R. ins.
C47	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C48	3.7pF	Variable	-	-	Mullard AC2002/3
C49	47pF	Silver mica	350V	2%	LEM. 1106R. ins.
C50	130pF	" "	350V	2%	LEM. 1106R. ins.
C51	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C52	56pF	Silver mica	350V	$\pm\frac{1}{2}$ pF	LEM. 1106R. ins.
C53	47pF	" "	350V	2%	LEM. 1106R. ins.
C54	150pF	" "	350V	2%	LEM. 1106R. ins.
C55	1000pF	Silvered mica	350V	2%	LEM. 1510E. ins.
C56	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C57	150pF	Silver mica	350V	2%	LEM. 1106R. ins.
C58	1000pF	Silver mica	350V	2%	LEM. 1510E. ins.
C59	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C60	33pF	Silver mica	350V	2%	LEM. 1106R. ins.
C61	130pF	" "	350V	2%	LEM. 1106R. ins.
C62	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C63	0.01 $\mu$ F	" "	400V	20%	Hunt W97/BM21K
C64		DELETED			
C65	32 $\mu$ F+32 $\mu$ F	Electrolytic	450V	-	Hunt KBC 564
C66	15pF	Silver mica	350V	2%	LEM. 1106R. ins.
C67	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C68	0.01 $\mu$ F	" "	150V	20%	Hunt W97/BM13K
C69	0.01 $\mu$ F	" "	400V	20%	Hunt W97/BM21K
C70	25 $\mu$ F	Electrolytic	12V	-	Hunt L28/1, JD26T, 85°C
C71	33pF	Silver mica	350V	2%	LEM. 1106R. ins.
C72	8 $\mu$ F	Electrolytic	350V	-	Hunt JB403K
C73	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C74	0.01 $\mu$ F	" "	150V	20%	Hunt W97/BM13K
C75	0.01 $\mu$ F	" "	400V	20%	Hunt W97/BM21K
C76	0.01 $\mu$ F	" "	400V	20%	Hunt W97/BM21K
C77	0.1 $\mu$ F	" "	350V	20%	Hunt W49/B512AK
C78	0.1 $\mu$ F	" "	350V	20%	Hunt W49/B512AK
C79	2.2pF	Ceramic	750V	$\pm\frac{1}{4}$ pF	Erie N750K

<u>Cct. Ref.</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol</u>	<u>Manufacturer and Type of Drawing No.</u>
C80		DELETED			
C81	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C82	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C83	2 $\mu$ F	Electrolytic	350V	-	Hunt JB570K
C84	220pF	Silver mica	350V	5%	LEM.1106R.ins.
C85	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C86	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C87	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BN13K
C88		SEE C65			
C89	33pF	Silver mica	350V	2%	LEM.1106R.ins.
C90	2 $\mu$ F	Electrolytic	350V	-	Hunt JB570K
C91	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C92	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C93	15pF	Silver mica	350V	2%	LEM.1106R.ins.
C94	120pF	Silver mica	350V	5%	LEM.1106S.ins.
C95	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C96	22pF	Silver mica	350V	2%	LEM.1106S.ins.
C97	1000pF	Silvered ceramic	750V	20%	FEC310K
C98	70pF	Variable, 12 vane	-	-	Oxley 464, with acetate case
C99	0.1 $\mu$ F	Tubular paper	350V	20%	Hunt W49/B512AK
C100	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C101	330pF	Silvered ceramic	750V	10%	FEC 427N750
C102	1000pF	Silvered ceramic	750V	20%	FEC 310K
C103	140pF	Silver mica	350V	5%	LEM.1106S.ins.
C104	0.005 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM20K
C105	330pF	Silvered ceramic	750V	10%	FEC.427N750
C106	0.02 $\mu$ F	Tubular paper	350V	20%	TCC CP33N
C107	70pF	Variable, 12 vane	-	-	Oxley 464, with acetate case
C108	330pF	Silver ceramic	750V	10%	F.E.C. 427N750
C109	0.1 $\mu$ F	"Visconol", paper	4KV	20%	T.C.C. CP57MO (70°C)
C110	0.25 $\mu$ F	Tubular paper	350V	25%	T.M.C. Z115565
C111	8 $\mu$ F	Electrolytic	350V	25%	Hunt JB403K
C112	50 $\mu$ F+50 $\mu$ F	Electrolytic	150V	25%	Hunt JF163T
C113		SEE C112			
C114	2 $\mu$ F	Electrolytic	450V	-	Dubilier Type BR.E5164
C115	0.25 $\mu$ F	Tubular paper	350V	25%	T.M.C. Z115563
C116	32 $\mu$ F+32 $\mu$ F	Electrolytic	450V	-	Hunt KB C564
C117	16 $\mu$ F	Electrolytic	450V	-	Hunt JF554T
C118	2 $\mu$ F	Electrolytic	450V	-	Dubilier Type BRE5164
C119	0.1 $\mu$ F	"Visconol", paper	4KV	20%	T.C.C. CP57MO (70°C)
C120		SEE C116			
C121	16 $\mu$ F	Electrolytic	450V	-	Hunt JF554T
C122	0.1 $\mu$ F	Tubular paper	350V	20%	Hunt W49/B512AK

<u>Cct.</u> <u>Ref</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol</u>	<u>Manufacturer and</u> <u>Type or Drawing No.</u>
C123	0.1 $\mu$ F	"Visconol", paper	4KV	20%	T.C.C. CP57M0 (70°C)
C124	0.1 $\mu$ F	"Visconol", paper	4KV	20%	" "
C125	1000pF	Silvered ceramic	750V	20%	F.E.C. 310K
C126	130pF	Silver mica	350V	2%	LEM.1106R.ins
C127	220pF	Silver mica	350V	5%	" "
C128	82pF	Silver mica	350V	5%	LEM.1106R.ins
C129	0.01 $\mu$ F	Tubular paper	150V	20%	Hunt W97/BM13K
C130	0.01 $\mu$ F	Tubular paper	400V	20%	Hunt W97/BM21K
C131	0.0039 $\mu$ F	Silvered mica	500V	5%	Hunt L4/37
C132	270pF	Silver mica	350V	2%	LEM.1106S.ins.
C132A	47pF	Silver mica	350V	2%	LEM.1106R.ins.
C133	120pF	Silvered ceramic	750V	5%	F.E.C. 316N750
C134	70pF	Variable, 12vane	-	-	Oxley 464, with acetate case
C135	270pF	Silver mica	350V	2%	LEM.1106S.ins.
C136	120pF	Silvered ceramic	750V	5%	F.E.C. 316N750
C137	70pF	Variable, 12vane	-	-	Oxley 464, with acetate case
C138	270pF	Silver mica	350V	2%	LEM.1106S.ins.
C139	120pF	Silvered ceramic	750V	5%	F.E.C. 316N750
C140	70pF	Variable, 12vane	-	-	Oxley 464, with acetate case
C141	220pF	Silver mica	350V	5%	LEM.1106S.ins
C142	120pF	Silvered ceramic	750V	5%	F.E.C. 316N750
C143	70pF	Variable, 12vane	-	-	Oxley 464, with acetate case
C144	330pF	Silver mica	350V	5%	LEM.1106S.ins.

### INDUCTORS

L1*	2-3 Mc/s Band Pass filter Assy.	Racal BA11739
L2*	1.5 Mc/s I.F.T. Assy.	Racal BA11283
L3*	1.5Mc/s I.F.T. Assy.	Racal BA11826
L4*	100 kc/s Suppressor Grid Coil	Racal BA11816
L5*	100 kc/s I.F.T. Assy.	Racal BA11277
L6	30 $\mu$ H Coil Assy.	Racal BA11275
L7*	100 $\mu$ H Coil Assy.	Racal BA11821
L8	30 $\mu$ H Coil Assy.	Racal BA11274
L9*	1.4 Mc/s I.F.T. Assy.	Racal BA11817
L10*	Harmonic Mixer Grid Coil Assy.	Racal BA11817
L11	L.P.F. Inductor Assy.	Racal BA11997
L12*	3.5-4.5 MC/s Transformer	Racal BA11805
L13	100 kc/s Coil Assy.	Racal BA11271
L14*	3.5-4.5 Mc/s Transformer	Racal BA11998
C15*	" " " " " " "	Racal BA11804
L16*	" " " " " " "	Racal BA11804

<u>Cct.</u> <u>Ref.</u>	<u>Description</u>	<u>Manufacturer, Type or</u> <u>Drawing No.</u>
L17	3.5 - 4.5 Mc/s Sweep Osc. Coil	Racal AA11280
L18	Coil Assembly	Racal AA11904
L19	R. F. Choke )	Bulgin Q602, Finish to Racal AS.9197
L20	R. F. Choke )	
L21	Part of L5 Assembly	
L22	Smoothing Choke 25H, 25mA	Permeko P2583/2C
L23	Smoothing Choke 5H, 200mA	Racal T1081
L24	L. C. F. Ferroxcube Coil Assy.	Racal BA4758
L25	L. C. F. Ferroxcube Coil Assy.	Racal AA4915
L26	L. C. F. Ferroxcube Coil Assy.	Racal AA4915
L27	L. C. F. Ferroxcube Coil Assy.	Racal BA4843
	* Including associated Capacitor(s) and Resistor(s).	

### TRANSFORMERS

T1	E. H. T. Transformer	Racal BT10663
T2	Mains Transformer	Racal BT10662

### VALVES

V1	R. F. Amplifier	.6BA6 (CV454)
V2	1st Mixer	.6BE6 (CV453)
V3	2nd Mixer	.6AS6 (CV2522)
V4	100 kc/s I. F. Amplifier	.6BA6 (CV454)
V5	Detector	.6AL5 (CV283)
V6	A. G. C.	.6AL5 (CV283)
V7	"Y" Amplifier	.6AU6 (CV2524)
V8	"Y" Amplifier	.6AU6 (CV2524)
V9	Crystal Oscillator	.6AU6 (CV2524)
V10	"X" Amplifier	.6AU6 (CV2524)
V11	"X" Amplifier	.6AU6 (CV2524)
V12	3rd Mixer	.6AS6 (CV2522)
V13	4th Mixer	.6AS6 (CV2522)
V14	5th Mixer	.6AS6 (CV2522)
V15	Buffer Amplifier	.12AT7 (CV455)
V16	Buffer Amplifier	.6AU6 (CV2524)
V17	100 kc/s Pip Generator	.12AT7 (CV455)
V18	Wideband Harmonic Amplifier	.6AU6 (CV2524)
V19	Buffer Amplifier	.6AU6 (CV2524)
V20	Sweep Oscillator	.6AS6 (CV2522)
V21	Control	.12AT7 (CV455)
V22	Saw-Tooth Sweep Generator	.6AU6 (CV2524)
V23	Saw-Tooth Sweep Generator	.6AU6 (CV2524)
V24	Mono-Stable Multivibrator	.12AT7 (CV455)
V25	Rectifier (1-110V)	.6X4 (CV493)
V26	H. T. Rectifier	.5V4G (CV729)
V27	DELETED	

<u>Cct</u> <u>Ref</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol</u>	<u>Manufacturer and</u> <u>Type or Drawing No</u>
V28	Stabiliser (110V)				VR150/30 (CV.216)
V29	E.H.T. Rectifier				1X2A (CV.5032)
V30	" "				1X2A (CV.5032)
V31	H.T. Stabiliser				VR150/30 (CV.216)
V32	" "				VR150/30 (CV.216)
V33	C.R.T.				DP.16-22 (CV.24980)

### SWITCHES

SA	Marker				Racal BSW. 11290
SB	Bandwidth				Racal BSW. 11894/5/6
SC	Sweep Time Secs				Racal BSW. 11289
SD	Lin/Log				N.S.F., Z. 510554
SE	Power (on/off)				N.S.F., Z. 510554

### POTENTIOMETERS

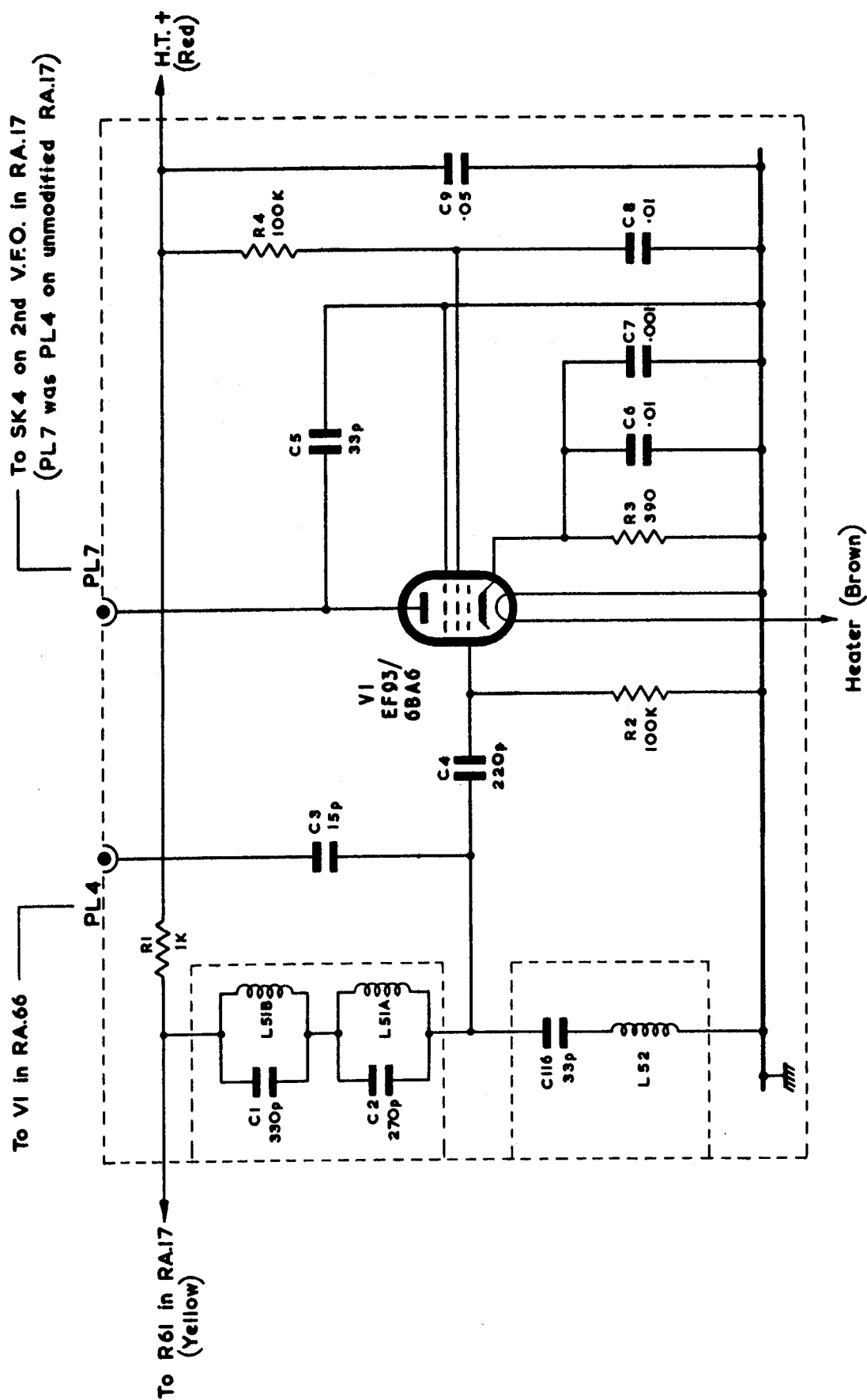
RV1	5k $\Omega$	R.F.Gain Linear			Racal ASW. 11770
RV2	5k $\Omega$	Spectrum Centre, Linear			Racal ASW. 11770
RV3	1M $\Omega$ )				
	)	Spectrum Width tandem, Linear			Racal ASW. 11771
RV4	1M $\Omega$ )				
RV5	100k $\Omega$	Cal. Marker Level, preset, Linear			Racal ASW. 11773
RV6	250k $\Omega$	Focus, Linear			Racal ASW. 11987
RV7	50k $\Omega$	Brightness, Linear			Racal ASW. 11986
RV8	2M $\Omega$	"X" Amplifier Gain, preset, Linear			Racal ASW. 11772
RV9	10k $\Omega$	"X" Shift, Linear			Racal ASW. 11774
RV10	250 $\Omega$	Diode Bias, preset			Racal ASW. 13136
RV11	470k $\Omega$	"Y" Shift, Linear			Racal ASW. 11775
RV12	500 $\Omega$	Fine Tune (Spectrum Centre), Linear			Racal ASW. 13137
RV13	1k $\Omega$	Tuning Marker Level, preset			Racal ASW. 13135

### MISCELLANEOUS

FS1	3A	Power fuse			Belling Lee L. 1055
FS2	250mA	H.T. fuse			Belling Lee L. 1055
ILP1		Indicator lamp (power ON)			8V., 0.15A., MES.
XL1		100 kc/s Crystal Marker Generator			Brooks BD 6905
		Brooks Style "G"			Style "G"
XL2		1.4 Mc/s Crystal Oscillator			Cathodeon BD 10963
					Style "D"
XL2		Clip for above			AD 4912 (Racal )
		Crystal Holder (XL2)			McMurdo X2/UB
		Crystal Holder (XL1)			McMurdo XM7/UC1
		Screening Can (XL1)			McMurdo 9/6

<u>Cct</u> <u>Ref</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol.</u>	<u>Manufacturer and</u> <u>Type or Drawing No.</u>
MR1		Silicon Diode Rectifier			BTH Type SJ401B
		Cable, Coaxial (LCF)			Relcon K16M
		Cable, Coaxial (Interlink)			Uniradio 70
		Cooling Air Fan			Planair 2 PLW -179
		Ferrite Bead			Mullard FX1115
		Fine Tune Knob			AD 12391 (Racal)
		Knob, Small skirt			
		("X" shift, "Y" shift			
		R.F. Gain; Brightness;			
		Spectrum Centre; Spectrum			
		Width; Focus.)			
		Knob, finger (Bandwidth:			
		Marker; Sweep-time)			AD 6735 (Racal)
		Bevel Gear			AD 4850 (Racal)
		Coil Pad Washer )			AD 10782 (Racal)
		)			
		Coil Locking Fad ) (L.17)			AD 10496 (Racal)
		Core (Neosid)			AD 11736 (Racal)
		Crystal Clip (XL2)			AD 4912 (Racal)
		Fuseholder (FS1 and 2)			Belling Lee L. 1055
		Plug - Signal Spectrum Input			Magnetic Devices
					9580013
		Plug - RA.17 2nd v.f.o. input			Magnetic Devices
					9580013
		CRT mask			S.I.C. Type 5828
		CRT Mu-metal shield			M.E.A. Type ST 34
		Fan			Planair 2PLW.179
		Flexible Coupler			Stratton Type 529
		Front Panel (engraved)			CD 11266 (Racal)
		Escutcheon			CD 11307 (Racal)
		Viewing Filter, Amber			Racal BA 11534
ILP1		Indicator Lamp M.E.S. 8V 0.15A			
		Signal Lamp Fittings			Bulgin D 277
		(Red) M.E.S.			
		Coaxial Interlink Cable			Racal AA 12147
		Socket for Coaxial Interlink			-
		Front Panel Assy.			Racal DA 11264
		Sub-Chassis Assy. (PIP			
		Generator and W.B. Amplifier			Racal CA 11270
		Rubber Shroud (EHT capacitors)			Cinch 77/528
		Low pass Filter Assy.			Racal AA 11285
		L.C. Filter Assy.			Racal CA 11889
XL1		Crystal Holder			McMurdo XM7/UC1
		Screening Can			McMurdo 9/6
V1 and		Valveholder			McMurdo XM7/UC1
V2		Screening Can			McMurdo 4/6

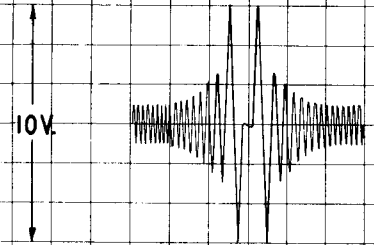
<u>Cct Ref</u>	<u>Value</u>	<u>Description</u>	<u>Rating</u>	<u>Tol</u>	<u>Manufacturer and Type or Drawing No.</u>
V3		Valveholder			McMurdo XM7/UC1
		Screening Can			McMurdo 11/6
V4		Valveholder			McMurdo XM7/UC
V11		Screening Can			McMurdo 4/6
V12 to		Valveholder			McMurdo XM7/UC1
V14		Screening Can			McMurdo 11/6
V15		Valveholder			McMurdo XM9/UC1
		Screening Can			McMurdo 7/6
V16		Valveholder			McMurdo XM7/UC1
		Screening Can			McMurdo 4/6
V17		Valveholder			McMurdo XM9/UC1
		Screening Can			McMurdo 7/6
V18		Valveholder			McMurdo XM7/UC1
		Screening Can			McMurdo 4/6
V19		Valveholder			McMurdo XM7/UC1
		Screening Can			McMurdo 4/6
V20		Valveholder			McMurdo XM7/UC1
		Screening Can			McMurdo 11/6
V21		Valveholder			McMurdo XM9/UC1
		Screening Can			McMurdo 7/6
V22 and		Valveholder			McMurdo XM7/UC1
V23		Screening Can			McMurdo 4/6
V24		Valveholder			McMurdo XM9/UC1
		Screening Can			McMurdo 7/6
V25		Valveholder			McMurdo XM7/UC1
		Screening Can			McMurdo 9/6
V26		Valveholder I.O.			McMurdo X8/U
		Valve Retainer			Electrothermal VRK16
V28		Valveholder I.O.			McMurdo X8/U
		Valve Retainer			Electrothermal VRK7
V29 and		Valveholder			McMurdo BM9/UV
V30		Valve Retainer			Electrothermal VRK157
		Valve Top Cap Connector			Electrothermal TC4
		Valveholder Cover (Underchassis)			McMurdo No.9
V31 and		Valveholder I.O.			McMurdo X8/U
V32		Valve Retainer			Electrothermal VRK7
V33		CRT Base Assy.			





SAWTOOTH: flyback to sweep ratio 4:100  
 TEST POINT: V23 V10 V10 V11  
                  (k) (g') (a) (a)  
 AMPLITUDE: 110 50 300 300  
 FAST SWEEP: 0.2 sec. approx.  
 SLOW SWEEP: 2 sec. approx.

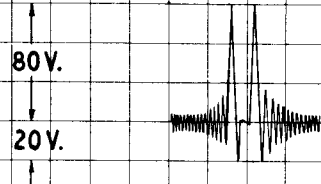
ANODE V14



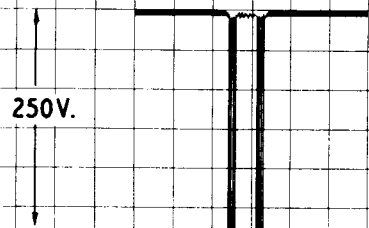
At the grid of V21B the sawtooth waveform shall be such that the oscillator V20 can be swept through 1Mc/s with the SPECTRUM WIDTH control in the fully clockwise position.

The SPECTRUM WIDTH and SPECTRUM CENTRE controls shall be non-interdependant and it must be possible to set the centre frequency to any value between 3.5 and 4.5 Mc/s

ANODE V15A



ANODE V15B



ANODE V24B

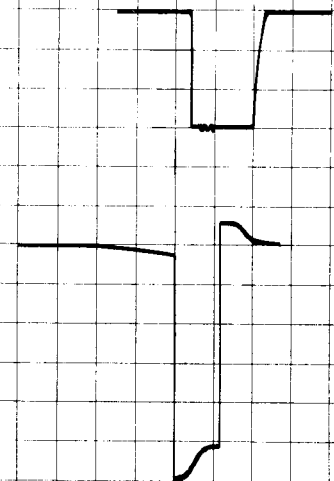
Slow: 10ms.  
 Fast: 3ms.  
 Amplitude: 130V.

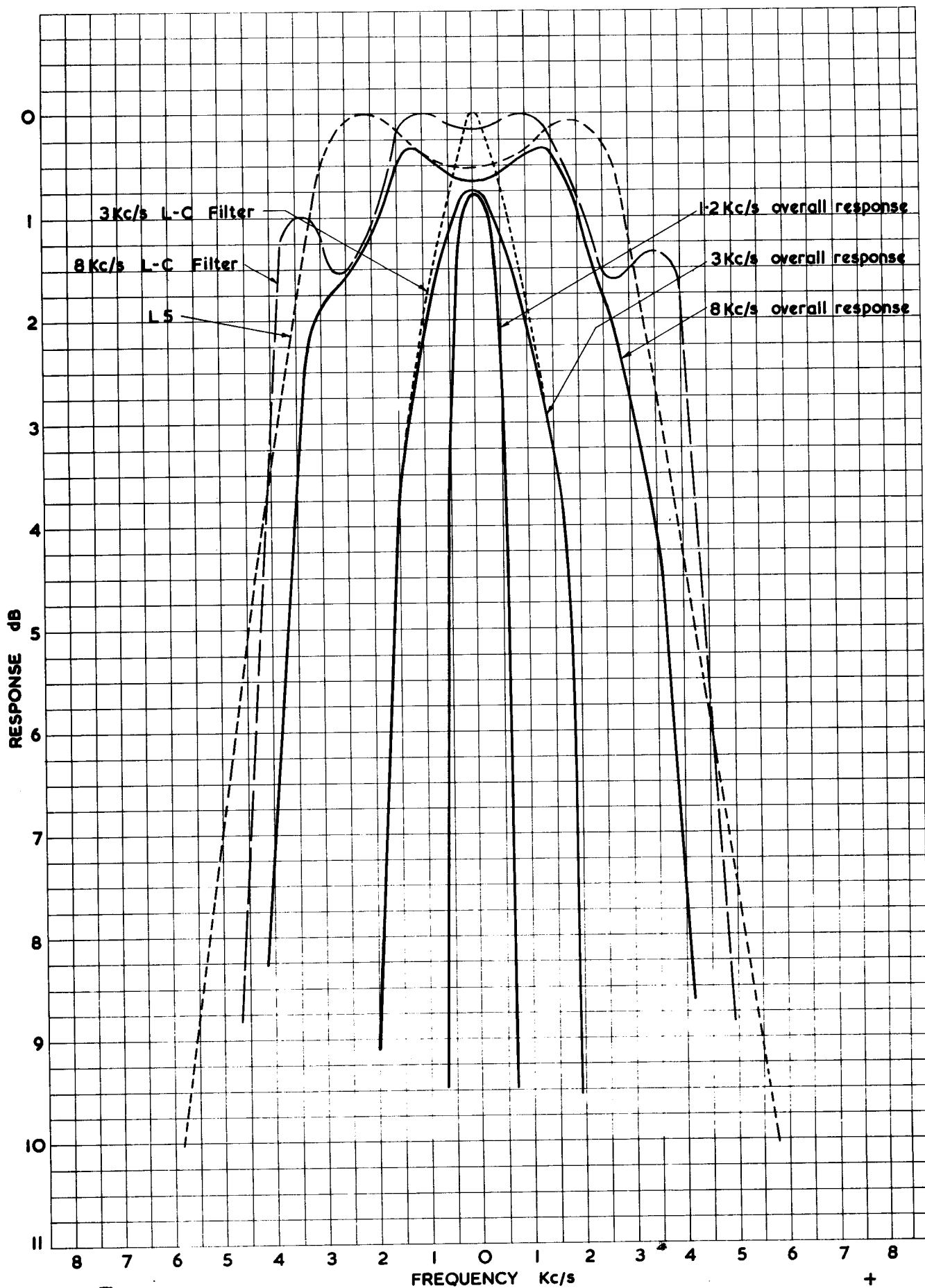
C.R.T. Y1 PLATE  
 As for V24B but  
 Amplitude 5V.

SCREEN (g") V22

Slow: 30-40ms.  
 Fast: 3-4ms.  
 Amplitude: 120V.

GRID OF C.R.T.  
 As for V22 but  
 Amplitude 20V.

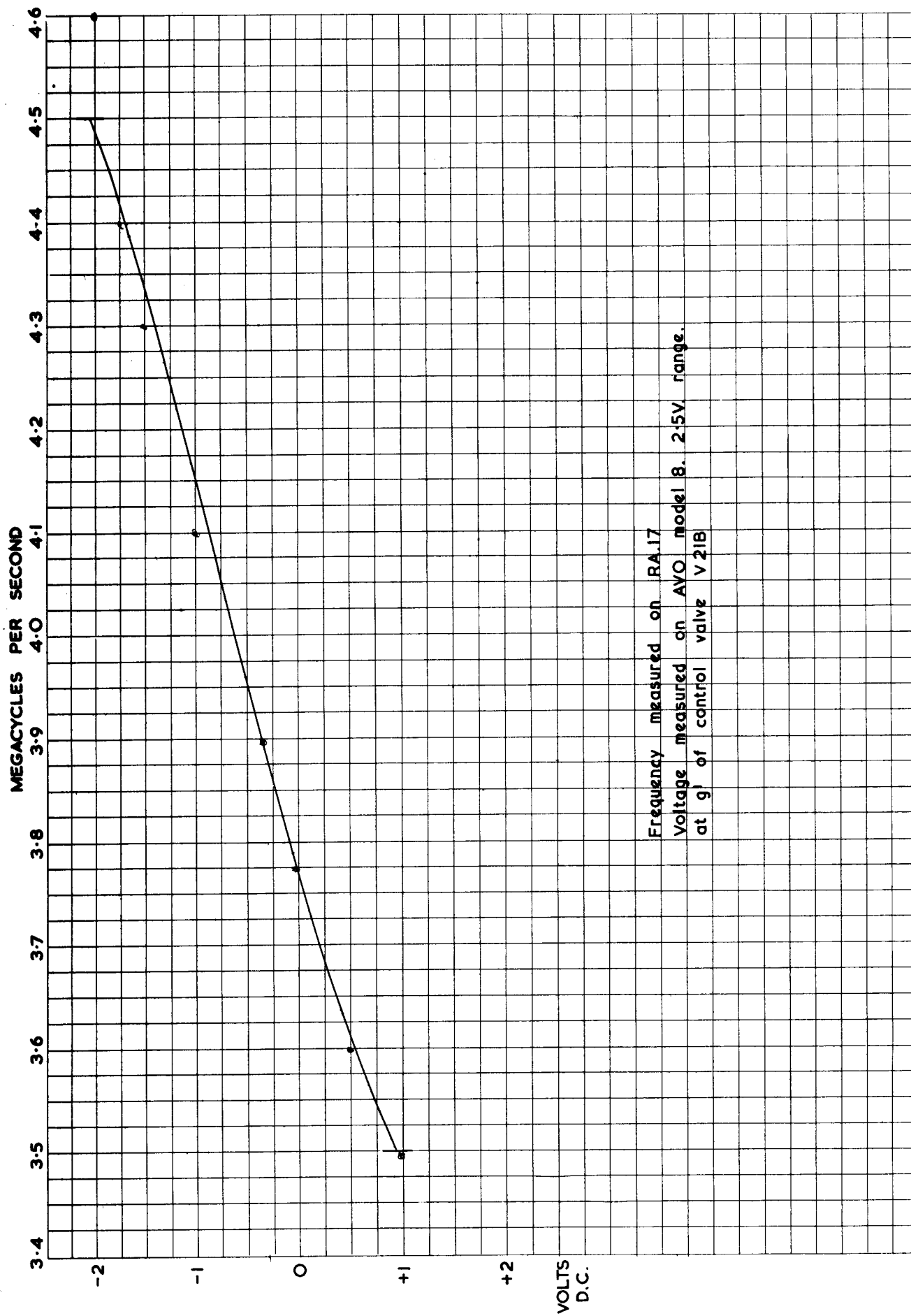




10605

100 KC/S RESPONSE - RA.66

FIG.7

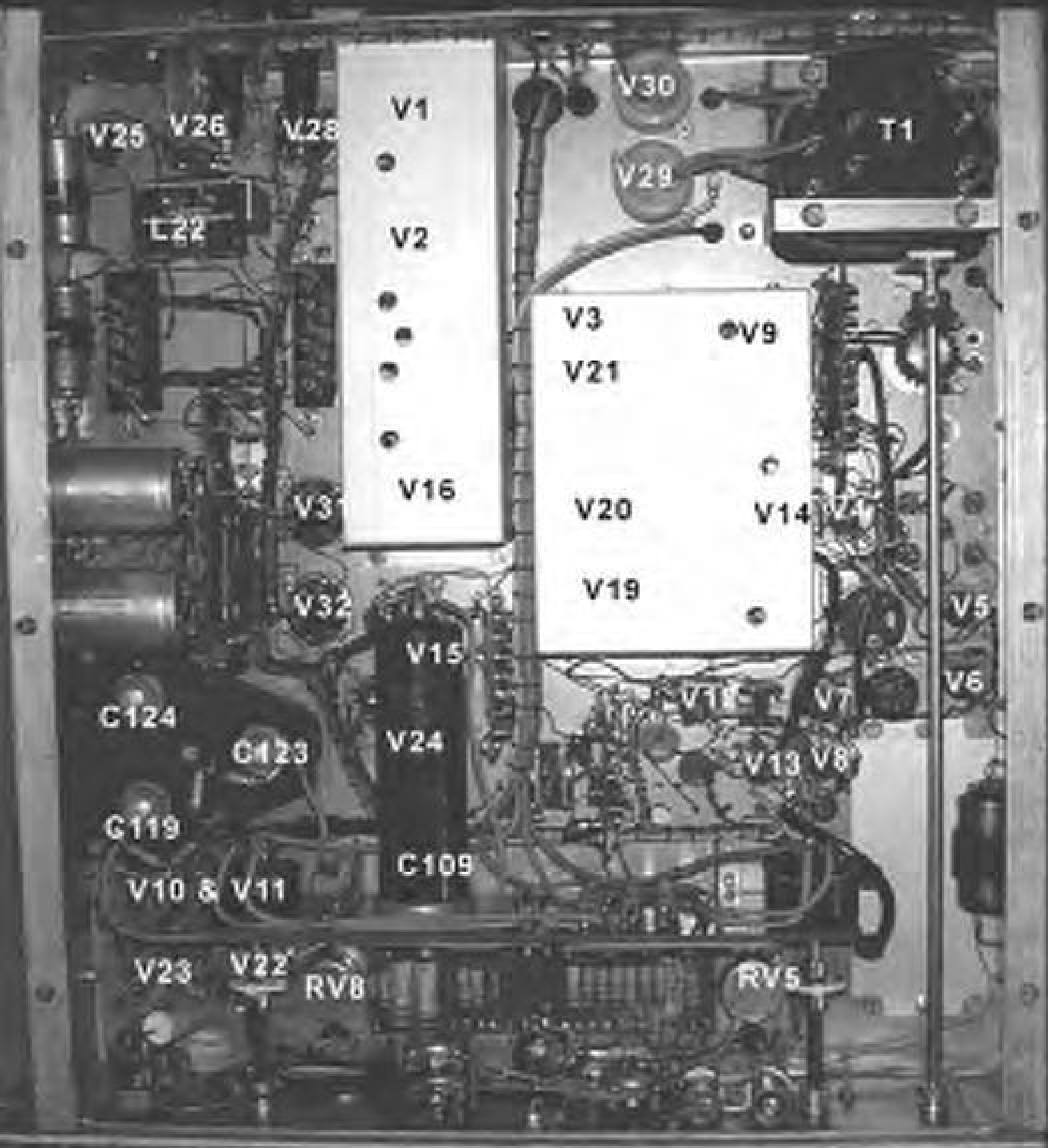


SWEEP OSCILLATOR RESPONSE - RA.66

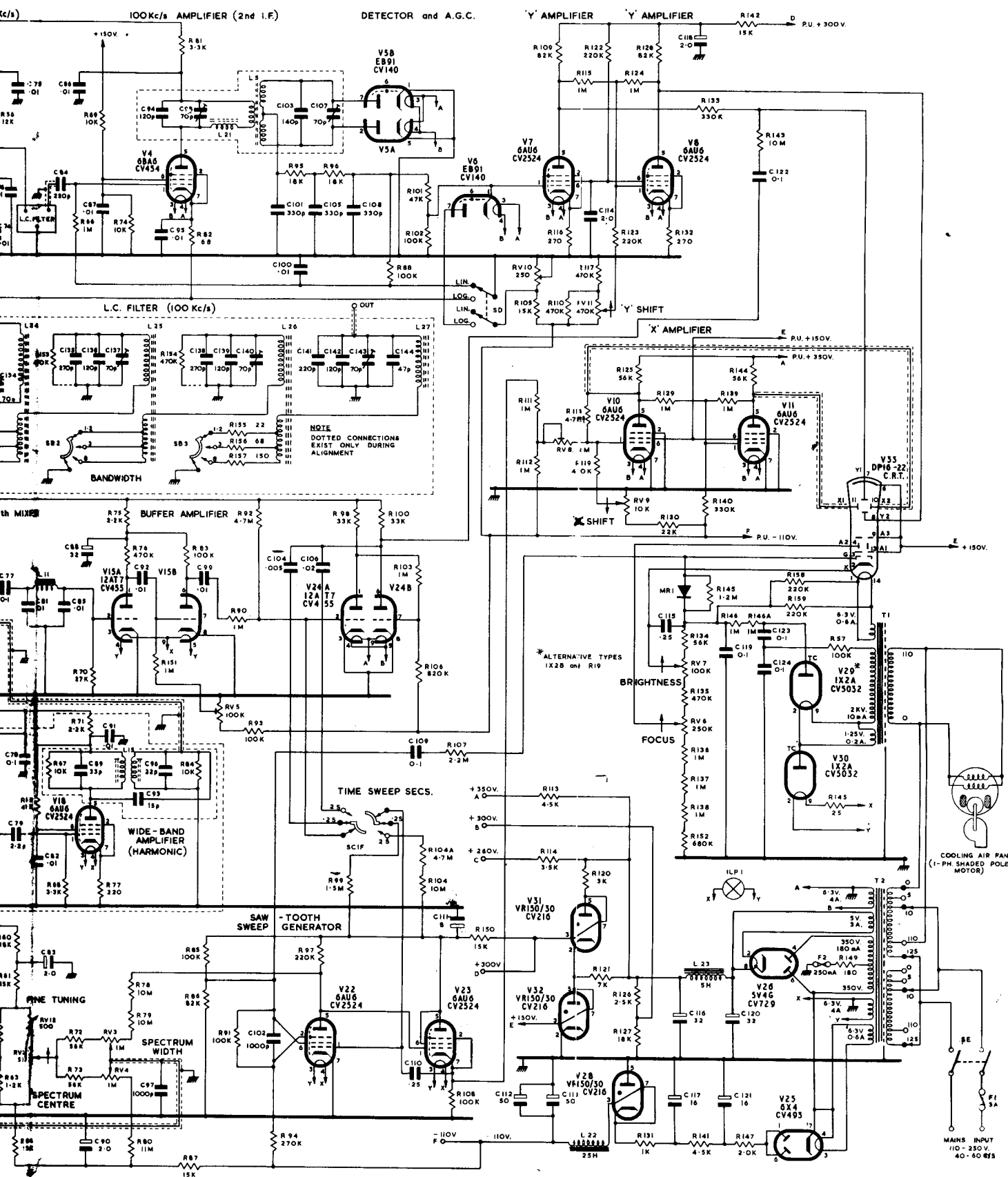
FIG.8

10606









ADAPTOR TYPE RA.66

Fig. 9

## SPECIAL MODIFICATION RA.17C-12-md and RA.17L-md

As a result of modifications to the RA.17C-12, and RA.17L when used with an RA.66 the a.v.c. and cross-modulation characteristics of the receiver are modified. This must be borne in mind when using the RA.17C-12 or RA.17L apart from the RA.66.

The modifications to the receiver are as follows:-

1. A buffer amplifier inserted between the 2nd and 3rd mixer stages, details of which are included in Part 1, Section 2 of the RA.66 manual.
2. Remove a.v.c. from r.f. valve ECC189 (V3) on 1st v.f.o. chassis by earthing screened connection to 1st v.f.o. terminal block.
3. Remove earth connection from Pin 2 of final i.f. transformer and connect to 82k $\Omega$  resistor (R102) via turret lug as shown on diagram overleaf.
4. Remove link between R91A and V24 (EA.76) as shown on diagram overleaf.
5. Remove (yellow) link across 470k $\Omega$  ( $\frac{1}{4}$ W) resistor as shown on diagram overleaf.
6. Disconnect 1.0 $\mu$ F capacitor (C188A), mounted adjacent to the A.V.C. switch (S6) on the main chassis, from the "LONG" position of this switch.
7. Remove 2nd v.f.o. and disconnect PL11 from the cathode of V12 (CV2524) and reconnect to the anode of V12 via a 2.2pF capacitor.
8. Remove R116A (5.6k) from pin 7 of V14.
9. Reconnect R116A as 10k $\Omega$  ( $\frac{1}{4}$ W) to pin 7 of V16.

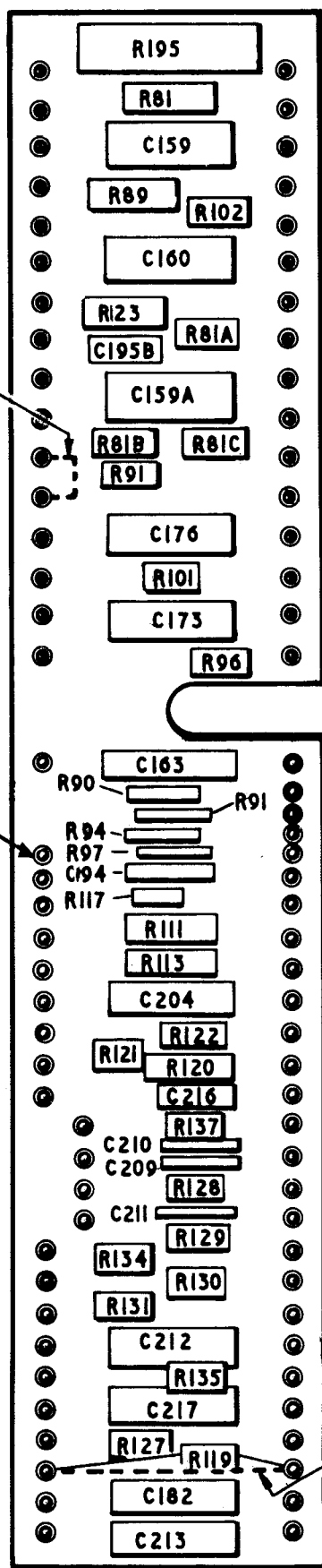
Items 8 and 9 do not apply to the RA.17L.



LINK CONNECTING  
R91A and V24

R102 VIA THIS  
TURRET LUG

LINK ACROSS  
470k RESISTOR



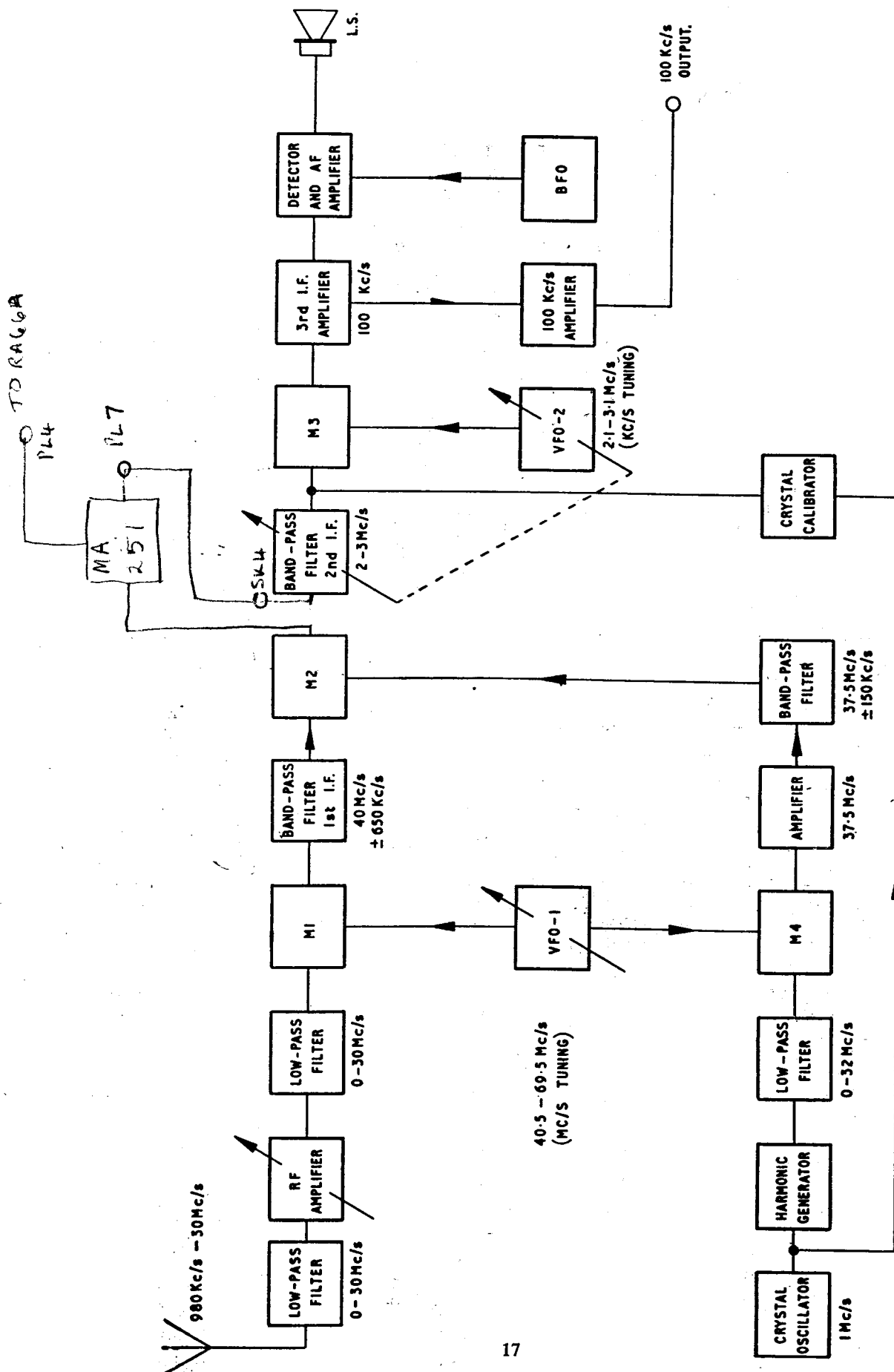


FIG. 1 BLOCK DIAGRAM OF THE RECEIVER TYPE RA.17

MODIFIED FOR RA66A

## RA66A Panoramic Adaptor

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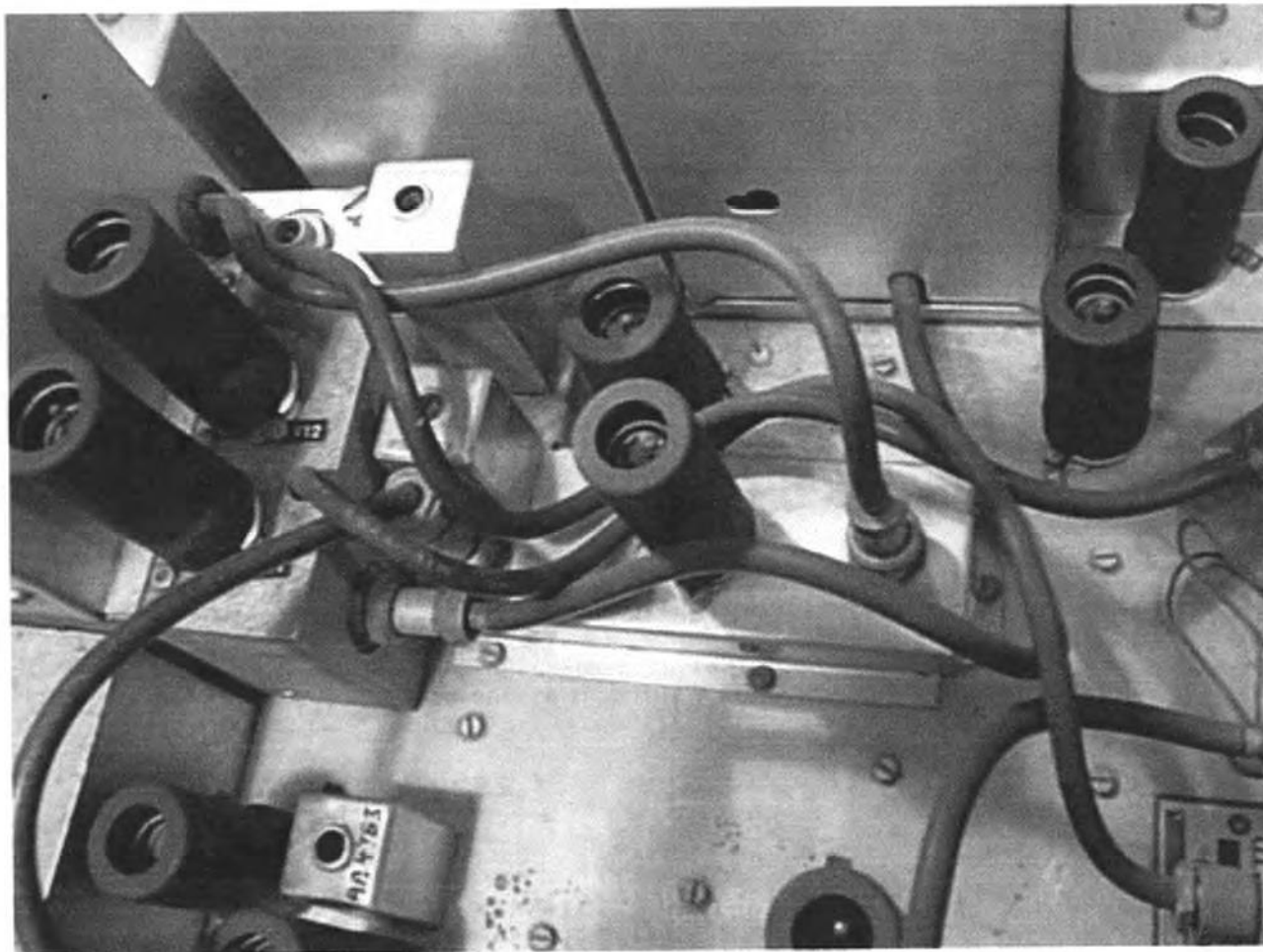
### Introduction.

Once again we have here in the RA66A, a very desirable piece of kit.

The RA66 is used to visually display signals in any 1mhz wide band from 1-30mhz using an RA17 receiver. The Cathode Ray Tube fitted to the RA66 can be adjusted to display between 1mhz to 100khz of spectrum and controls can be adjusted to centre the display on any part of this spectrum. Sweep time can be adjusted to 2,1,0.5, and 0.2 seconds (RA66B only). Signals can be displayed with bandwidths of 1.2 , 3 and 8 khz. Sensitivity will give 1" deflection on the CRT for 4uv input to the RA17. To aid tuning a marker can be set which will track the vfo on the CRT as the RA17 is tuned, and fixed markers can be switched in covering intervals of 100khz.

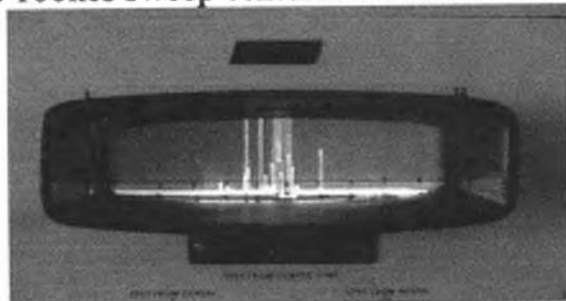
Unfortunately this is one adaptor which cannot just be connected to the RA17. A buffer amplifier is needed to connect between the RA17 and the RA66. This is called the MA251 and it is fitted on to the main chassis of the RA17 and connects electrically between the second and third mixers. Alterations have to be made to the I.F strip and also to the A.G.C. These modifications are well worth the effort, watching the CRT and seeing signals appear and disappear is quite interesting, as is watching a signal suddenly appearing and then immediately tuning to it.

Here is a picture of an RA17 fitted with the MA251

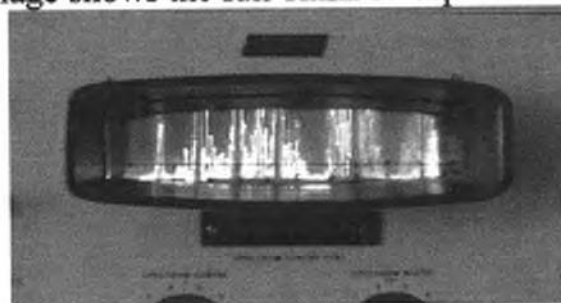


The MA251 is the assembly screwed onto the main chassis and is fitted with a single valve. It is in the center of the picture.

Here we have 100kcs sweep centered on 1.250 mhz .



This image shows the full 1mhz sweep from 1-2mhz.



## INSTRUMENT TUBE

Direct viewing instrument tube with a rectangular screen having an area of  $5\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. This tube is intended for radar or oscilloscope applications particularly where its shape provides a considerable saving of space compared with a circular tube.

**DB 16-22**  
**DG 16-22**  
**DP 16-22**

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – CATHODE RAY TUBES included in this volume of the handbook.

## HEATER

Suitable for series or parallel operation

$V_h$	6.3	V
$I_h$	300	mA

**Note** – (applies to series operation only). The surge heater voltage must not exceed  $9.5V_{r.m.s.}$  when the supply is switched on. When used in a series heater chain a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.

## CAPACITANCES

$C_{g-all}$	<10	pF
$C_{x'-all}$ ( $x''$ earthed)	<20	pF
$C_{x''-all}$ ( $x'$ earthed)	<20	pF
$C_{y'-all}$ ( $y''$ earthed)	<16	pF
$C_{y''-all}$ ( $y'$ earthed)	<16	pF
$C_{x'-y'}$	3.0	pF
$C_{x'-y''}$	3.0	pF
$C_{x''-y'}$	3.0	pF
$C_{x''-y''}$	3.0	pF

## SCREEN

Fluorescent colour:–

DB16-22	blue
DG16-22	green
DP16-22	blue with green afterglow

Persistence:–

DB16-22	short
DG16-22	medium
DP16-22	long

## FOCUSING

Electrostatic

## DEFLECTION

Double electrostatic.

Both x and y plates are suitable for symmetrical or asymmetrical deflection.

# DB 16-22 DG 16-22 DP 16-22

## INSTRUMENT TUBE

Direct viewing instrument tube with a rectangular screen having an area of  $5\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. This tube is intended for radar or oscilloscope applications particularly where its shape provides a considerable saving of space compared with a circular tube.

## MOUNTING POSITION

Any

This tube should not be supported by the base alone. The socket should under no circumstances be used to support the tube.

## TYPICAL OPERATING CONDITIONS

$V_{a3}$	5.0	kV
$V_{a2}$	600 to 700	V
$V_{a1}$	1.8	kV
$*V_g$	-25 to -70	V
$S_x$	0.19	mm/V
$S_y$	0.21	mm/V

\*In no circumstances must the grid be allowed to become positive with respect to the cathode.

## DEFLECTION SENSITIVITY LIMITS

$S_x$	$\frac{850 \text{ to } 1000}{V_{a3}}$	mm/V
$S_y$	$\frac{900 \text{ to } 1100}{V_{a3}}$	mm/V

## LIMITING VALUES (absolute ratings)

$*V_{a3}$ max.	6.0	kV
$V_{a2}$ max.	1.1	kV
$V_{a1}$ max.	2.5	kV
$-V_g$ max.	150	V
$I_k$ max.	300	$\mu$ A
$R_{g-k}$ max.	1.5	M $\Omega$
$V_{h-k}$ max.	$\pm 150$	V

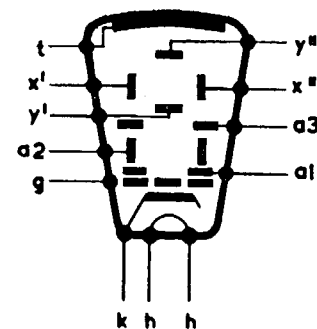
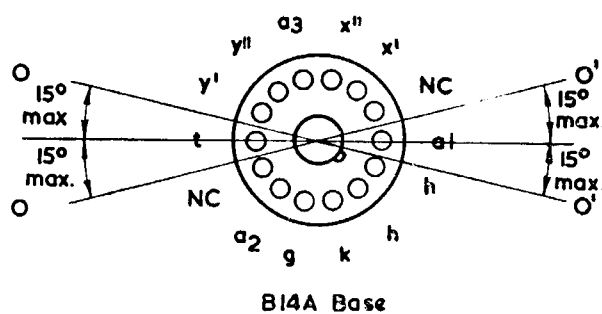
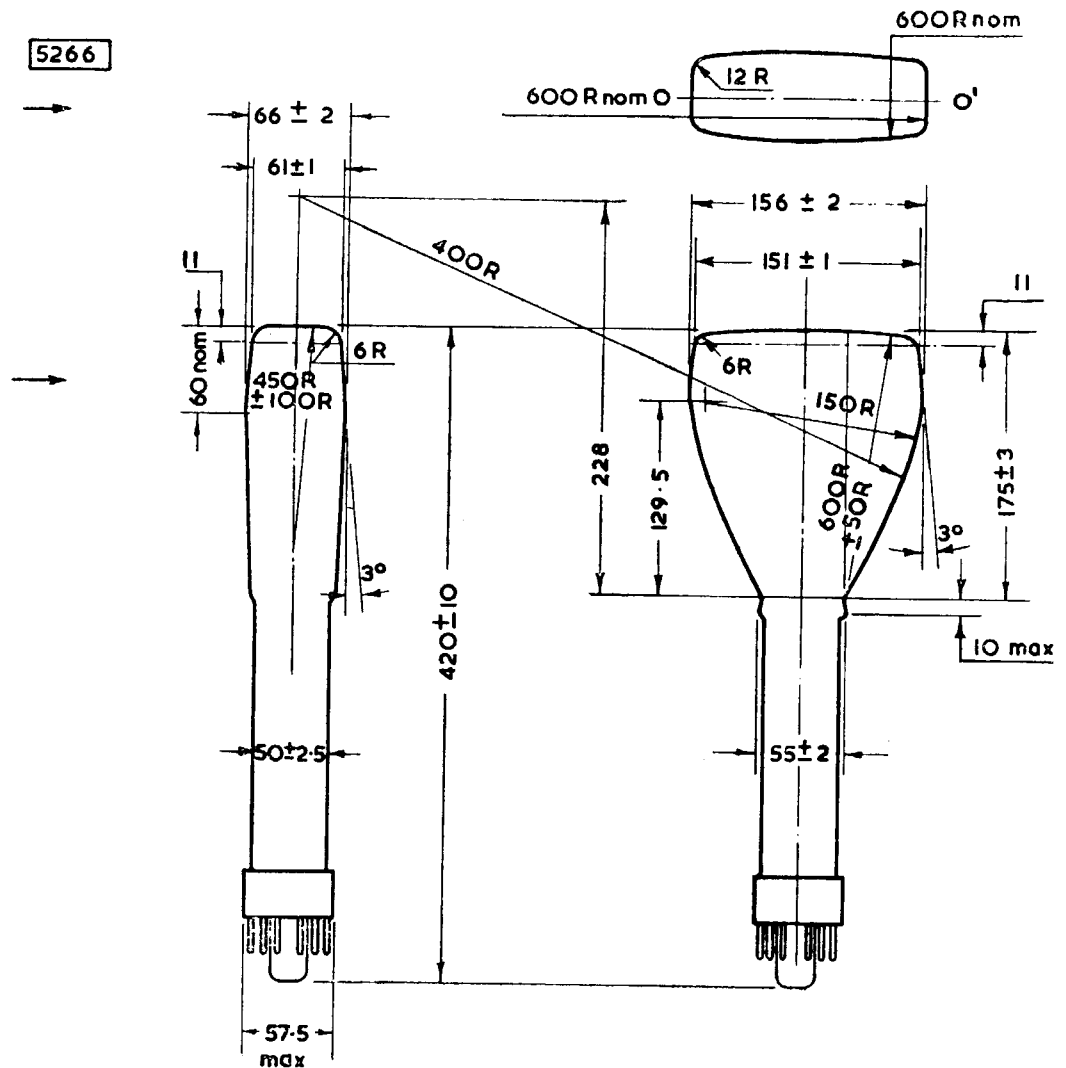
\*For optimum focus quality the potential between the screen and  $a_3$  must not exceed 10V.

**Note** – Viewed from the screen end with the major axis of the screen horizontal and pins 9 and 10 on the base uppermost, a positive voltage on  $x'$  will deflect the spot to the left and a positive voltage on  $y'$  will deflect the spot upwards. The horizontal deflection will be within  $2^\circ$  of the centre line through the screen. The angle between the  $x$  and  $y$  deflection will be  $88^\circ$  to  $92^\circ$ .

# INSTRUMENT TUBE

Direct viewing instrument tube with a rectangular screen having an area of  $5\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. This tube is intended for radar or oscilloscope applications particularly where its shape provides a considerable saving of space compared with a circular tube.

**DB 16-22**  
**DG 16-22**  
**DP 16-22**

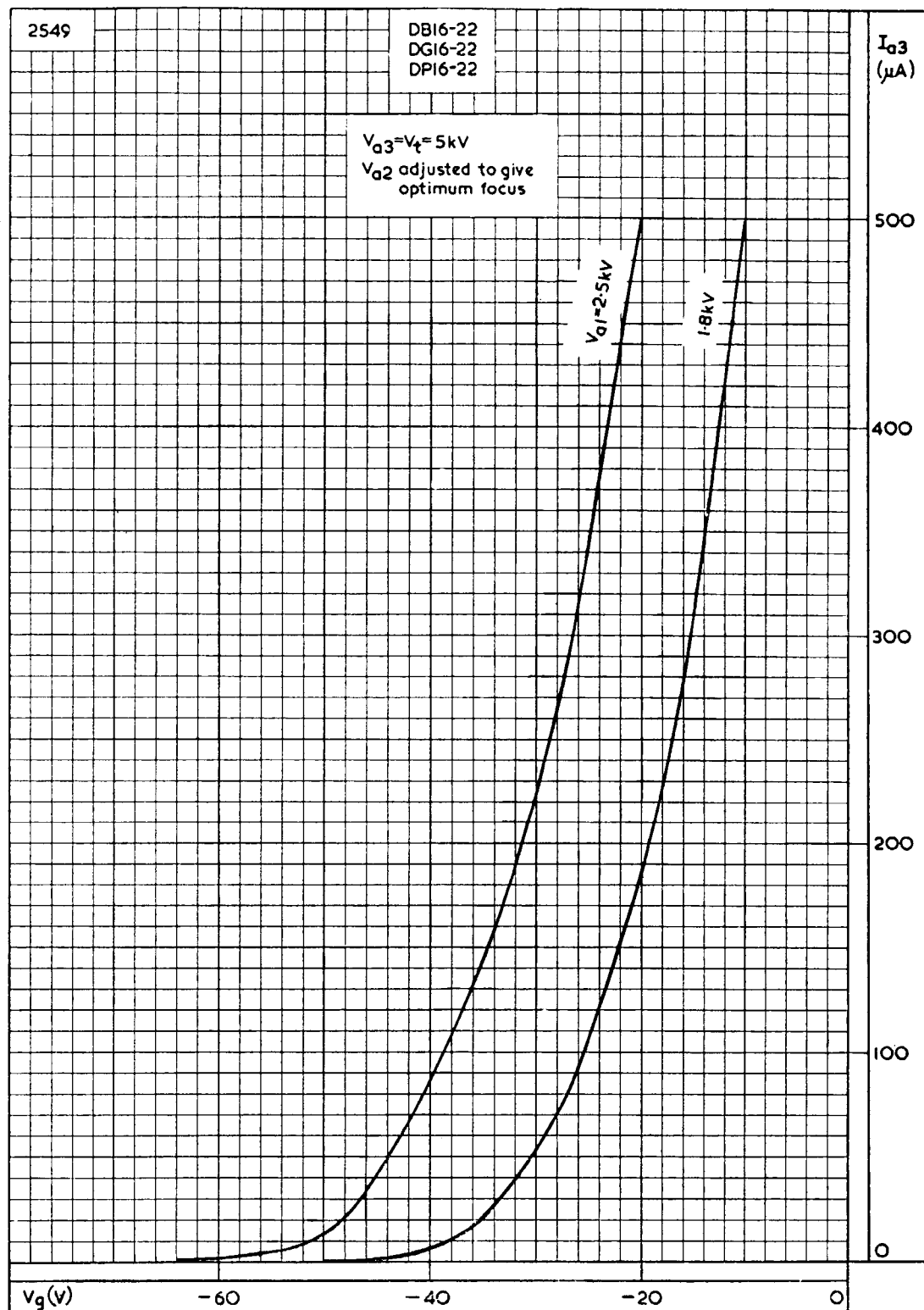


All dimensions in mm

# DB 16-22 DG 16-22 DP 16-22

## INSTRUMENT TUBE

Direct viewing instrument tube with a rectangular screen having an area of  $5\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. This tube is intended for radar or oscilloscope applications particularly where its shape provides a considerable saving of space compared with a circular tube.



FINAL ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE



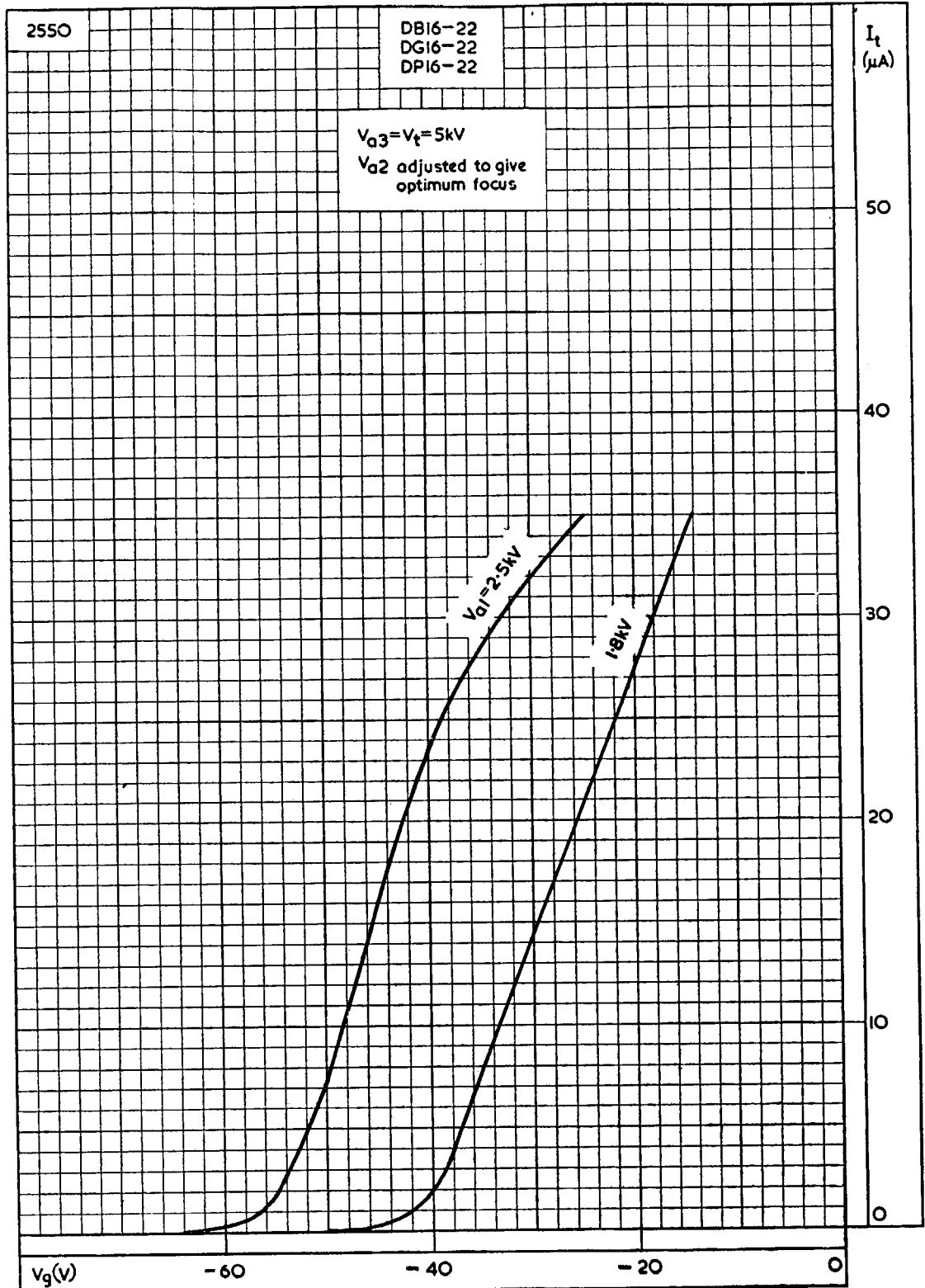
# INSTRUMENT TUBE

Direct viewing instrument tube with rectangular screen having an area of  $5\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. This tube is intended for radar or oscilloscope applications particularly where its shape provides a considerable saving of space compared with a circular tube.

**DB 16-22**

**DG 16-22**

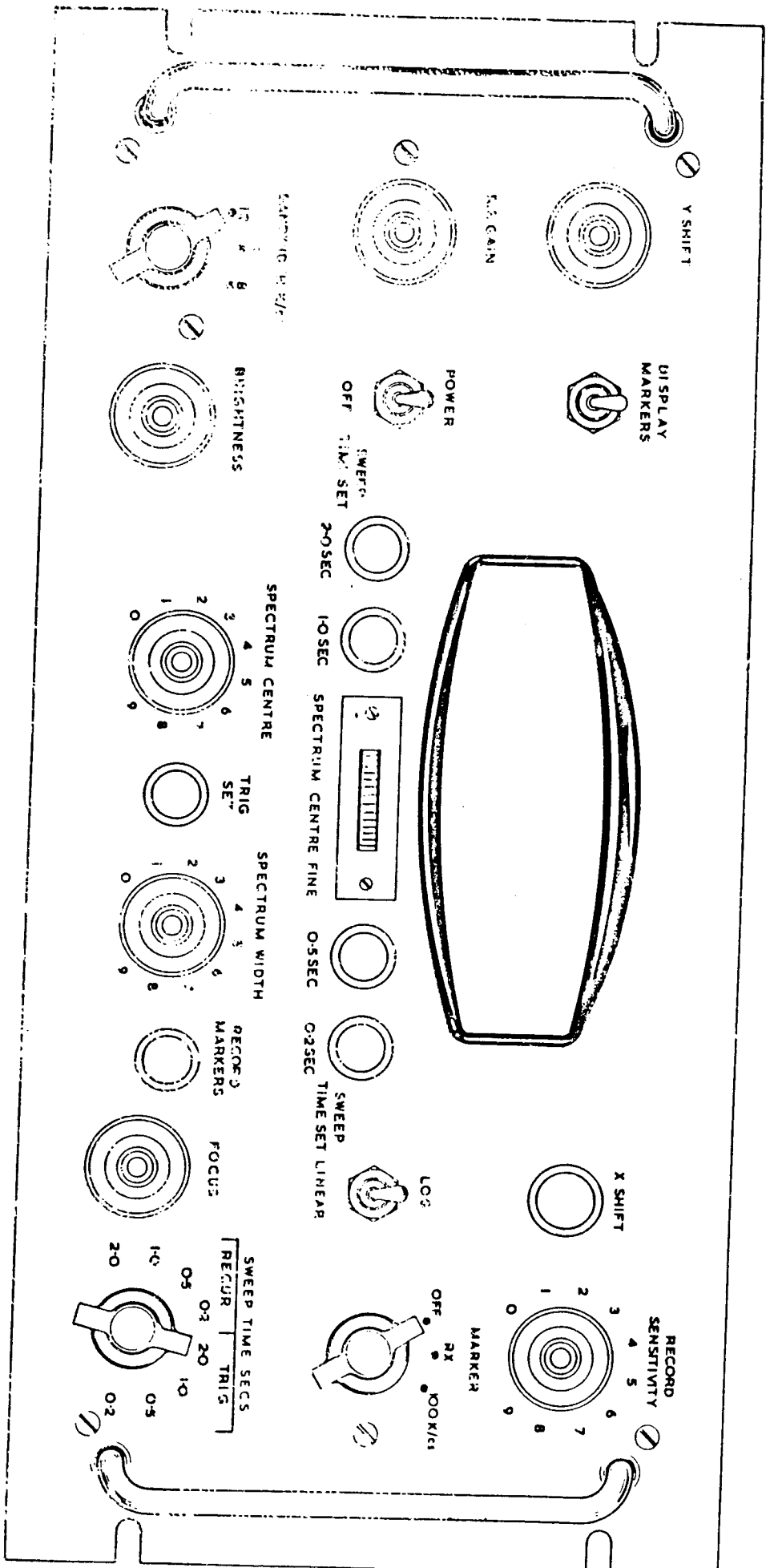
**DP 16-22**



SCREEN CURRENT PLOTTED AGAINST GRID VOLTAGE

# **RA-66B Panadaptor**

The following pages contain extracts from the RA-66B manual, showing the main differences between it and the RA-66A. The RA-66B differs from the A in having four selectable sweep speeds and a triggerable timebase. There are also a cathode follower outputs from the vertical deflection system and the sweep marker section, intended to be used by a “Mufax” chart recorder. The quality of the manual copy used for this section was not good and the scans represent the best possible result.



FOR RA.5501B  
PANORAMIC ADAPTOR TYPE RA.60B

## General Description

1. The Panoramic Adaptor Type RA.66B is used with the Communications Receiver Type RA.17 to provide a visual display of signals in any selected frequency band lying between 1 and 30 Mc/s. The maximum spectrum width that can be viewed is 1 Mc/s and this is selected by the MEGACYCLES tuning on the RA.17 Receiver; the spectrum on the cathode ray tube of the RA.66B can also be expanded to show wider spacing of viewed signals. The RA.66B is intended for use with Tone Generator and Voltage Control Unit MA.256 and the Mufax Recorder D-611-X to enable a recording to be made of the displayed spectrum.

### SWEEP TIME SECS Switch (SC)

10. For narrow band operation over spectra of the order 100 kc/s a sweep time of 0.2 secs or 0.5 secs is suitable. For wider spectra up to 1 Mc/s a sweep time of 1 sec or 2 secs should be used.

Time base speeds in the RECUR positions of this switch should be used when no recording is being made TRIG positions 0.5 and 1 sec should be used when the Mufax recorder is set to 120 or 60 rev/min respectively.

### RECORD MARKERS push button (SG)

- 16 The depressing of this pushbutton stops the printing of signals and allows the printing of the 100 kc/s markers or receiver marker depending on the position of the MARKER switch (para. 14-15). The markers will appear on the electrosensitive paper as heavy vertical lines, the right hand edge of the marker being the exact calibration point. A heavy black mark will appear on the left hand margin of the paper to differentiate between markers and signals.

### DISPLAY MARKERS switch (SF)

- 17 This switch disconnects the marker pulses from the 'Y' amplifier circuit and thus removes the marker deflections on the c. r. t. but does not remove the marker output to the Mufax recorder.

The DISPLAY MARKER switch SF should be set to the off (up) position when a recording is being made and in the ON position when marker deflections are required on the c. r. t.

### RECORD SENSITIVITY control (RV21)

18. This control provides fine adjustment of the sensitivity for recording. If sufficient adjustment of sensitivity is obtainable with this control then the coarse record sensitivity preset control RV20 should be readjusted. The preset control RV20 is located on the top of the chassis in the front of V14.

### Signal Cathode Follower

14. The output from the Y1 amplifier (V7) is fed to the cathode follower (V34) to provide an output signal to the Tone Generator, which modulates a 1000 c/s tone which is fed to the Mufax recorder. The signal output is manually operated by the Record Sensitivity control.

### Signal Output

13. The Y1 amplifier output (V7) is fed to the grid of the cathode follower (V34) through RV20 and RV21 which are the coarse and fine sensitivity controls respectively. R175 and MR4 provide limiting to the signal on the grid of the cathode follower. The signal output is +2 Volts for 12 $\mu$ V input.

### Sweep Deflection and Sawtooth Generator

14. V10 and V11 form a pair of paraphase amplifiers employing considerable feedback and providing up to 600 volts deflection-voltage at the X plates of the c. r. t. Drive is obtained from the d. c. screen-coupled phantatron V22. Such a circuit is insensitive to changes of h. t. and/or valve parameters, and the anode excursion is maintained within close limits regardless of sweep rates.

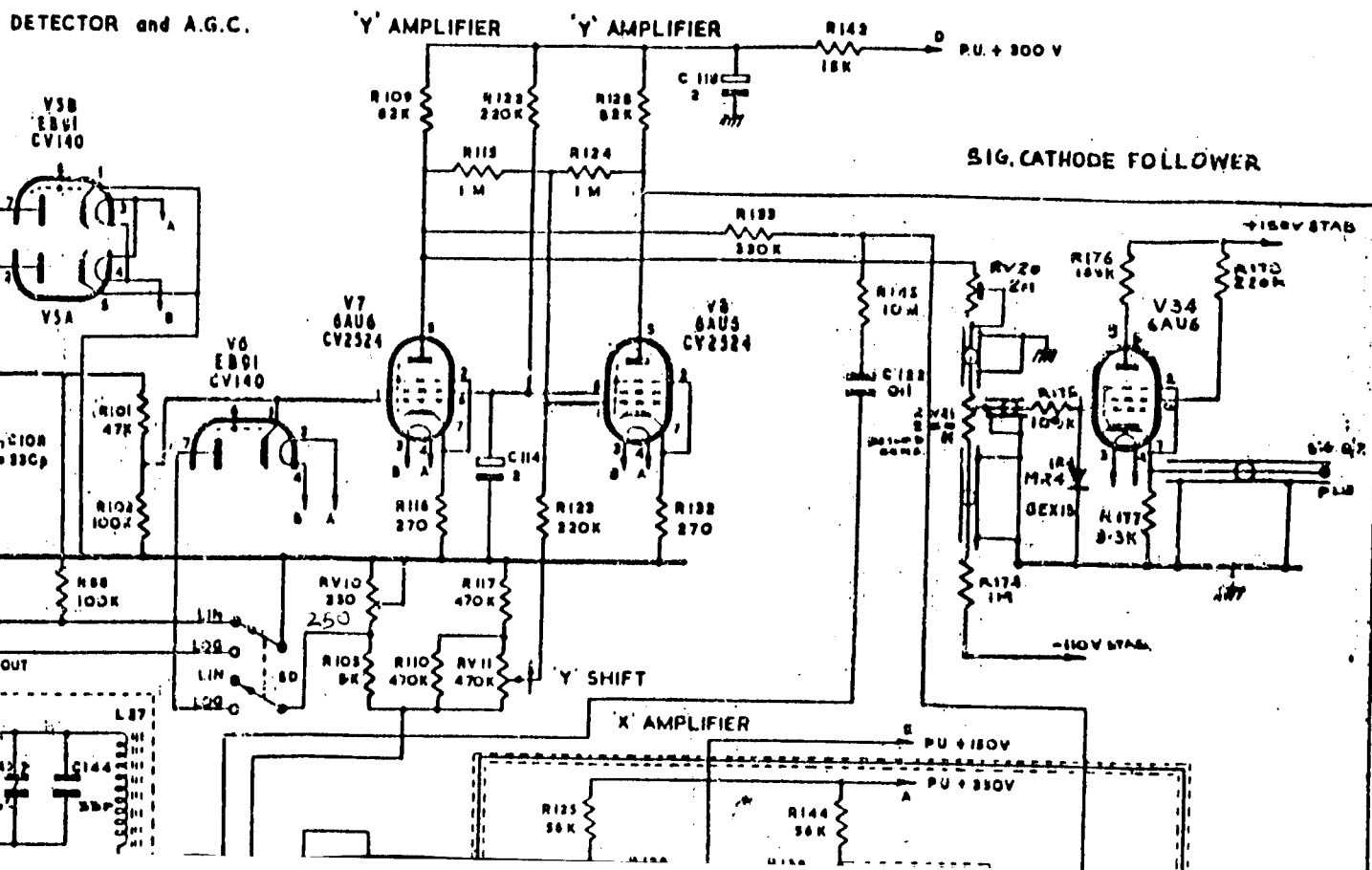
The sweep times used are 2 sec, 1 sec, 0.5 sec, and 0.2 sec. since a sweep rate in excess of 500 kc/s per second will result in ringing the 100 kc/s i. f. filter. Sweep times are determined by selection of the resistor chains associated with RV14, RV16, RV18 and RV19 circuit of V22. Flyback time is considerably reduced by the use of V23, the output impedance of which provides the resistive element of the flyback time-constant. Sweep flyback ratio is of the order 150:1 and flyback suppression is effected by using a fraction of the negative-going pulse at the screen of V22 to bias the c. r. t. grid during the flyback period. The time-constant of the coupling to the c. r. t. grid is made as long as possible and differentiation of the blanking pulse thus kept to a minimum. A silicon diode MR1, in the c. r. t. grid circuit, ensures d. c. restoration and thus prevents the "bright-up" which would otherwise occur.

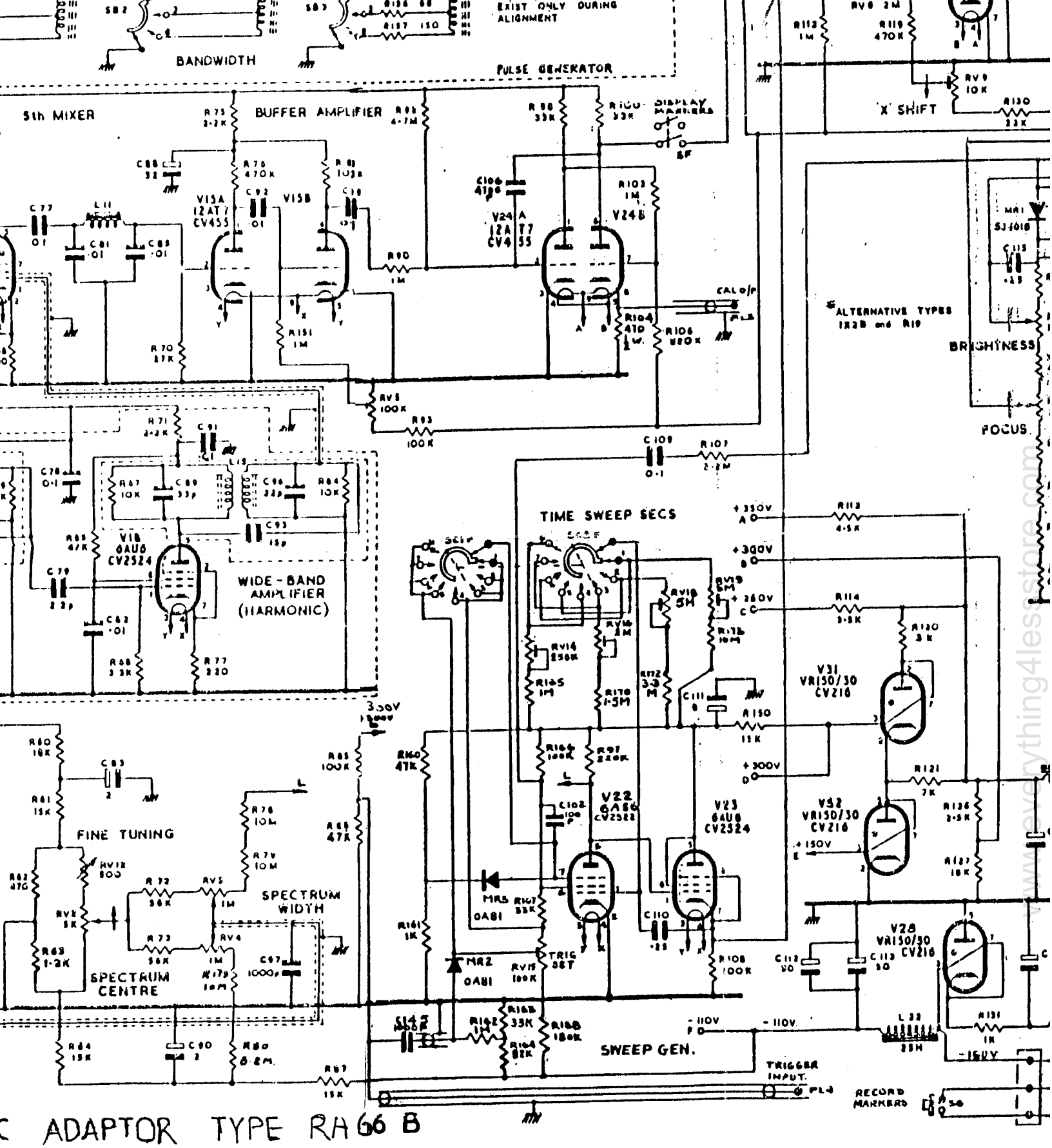
15. The saw-tooth generator can be used either free-running or triggered depending on the suppressor bias voltage selected.

16. Initiation of the sweep in the triggered condition is obtained by a positive pulse produced at the suppressor of V22 (phantastrom sweep generator). This pulse is produced by momentary opening of the TRIGGER INPUT connection in the Mufax Recorder at the commencement of each scan.

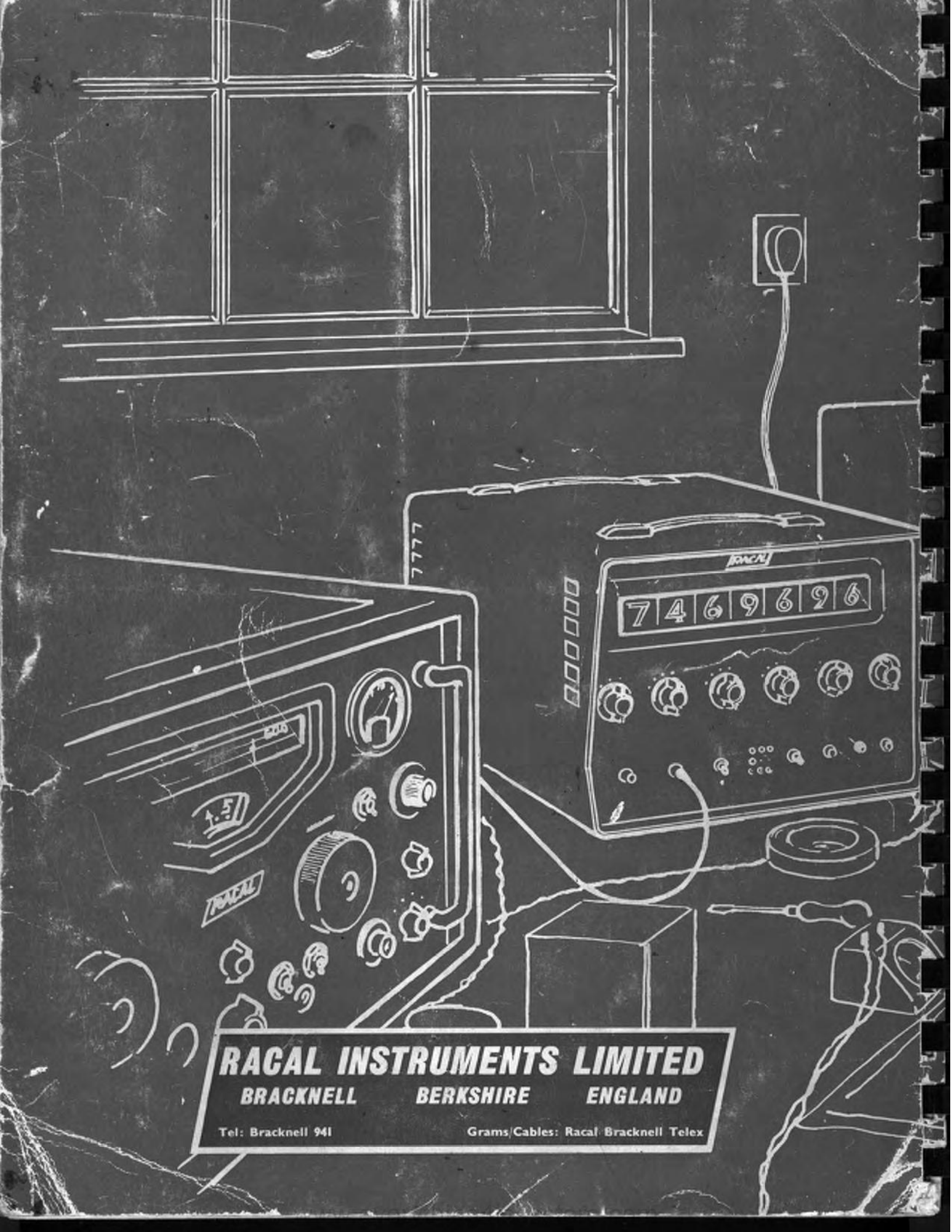
17. This removes the short-circuit across R86 in the RA. 66B producing a positive pulse which is differentiated through C145 and R162 and is fed to the suppressor of V22 via MR2 and switch wafer SC1F. The TRIG SET control is included to set the voltage at the suppressor which will just cut off the valve in the absence of a triggered pulse.

DETECTOR and A.G.C.









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